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EDITORIAL.

Agricultural Enterprise.

During the period of prosperity in the rubber planting industry it was almost impossible to direct attention to the commercial possibilities of other crops in Malaya. Even the coconut industry existed mainly by reason of the capital already sunk in it, backed, it must be admitted, by a small band of enthusiasts who had faith in the crop. The plantation oil palm industry was in its infancy and capitalists were generally adverse to developing the industry which at that time had little data to demonstrate its possibilities. Other crops grown, such as pineapple and gambier, existed merely as catch crops for rubber, while the majority of the remaining crops were in the hands of small-holders.

These secondary crops were unable to hold out the promise of high profits such as those enjoyed by the investors in the rubber industry, and the country therefore lost the advantage which a wider range of crops would have given through periods of trade despression.

The change of fortune in the rubber industry early led to quickened interest in other crops suitable for cultivation in Malaya and which might prove remunerative.

It is perhaps unfortunate that this interest in other crops should coincide with a period when capitalists and investors are reluctant to embark on new agricultural projects until they are able to visualise more clearly a general trade revival. This cautiousness, however, irritating as it may be to those who are convinced of the future prospects of particular crops, may ultimately prove to be to the advantage of the country, because it will mean that any developments made or contemplated are put into effect only after an exhaustive survey of the financial and economic factors involved. It may therefore result in constructive enterprise which will be less liable to the collapse caused by unforeseen circumstances which has been the unhappy feature of many projects in the past.

In spite of the difficulties of development of land which are inseparable from the present trade depression, there has been an encouraging development of agriculture in Malaya in several directions. During the past three years, the area under oil palms has increased by 30,000 acres, pineapples by 10,000 acres, coffee by 2,000 acres, tea by 2,000 acres and tobacco by 1,400 acres.

These extensions may not appear great, but they represent a move in the right direction and we confidently anticipate further extensions of the areas planted with these and other crops.

In 1930, the Cameron Highlands Development Committee published a small guide book to the Cameron Highlands. This publication gives information of use to those who wish to inspect land in that region and particulars under which land will be alienated. The Highlands open up new possibilities for agricultural enterprise which capitalists and others have not been slow to recognise.

There is, however, a demand for any information available concerning the agricultural possibilities of the Highlands. To meet the demand, at least in part, we include in this number an article by Mr. B. Bunting on the agricultural possibilities of Cameron Highlands. This information may be supplemented by reference to an article published in Volume VIII, No. 1 of this Journal on "Agriculture at Cameron's Highlands", by the same author.

While it is not claimed that the information contained in the present article embraces the scope of agricultural development possible in this region, or that it deals exhaustively with the crops stated, it should lead the reader who is interested in this direction to review the pros and cons of each crop and to have the advantage of the experience gained by the Department at its experimental area at Tanah Rata, Cameron Highlands.

The area suitable for agricultural development is not confined to the present Cameron Highlands, as there is much land outside this area which is suitable for the cultivation of upland crops.

While on the subject of widening the scope of agricultural enterprise in Malaya, we would take this opportunity of urging, once more, the local consumption of Malayan produce where available. To take but two such products, we have had ample opportunity of testing both tea and coffee locally produced and consider them excellent. Local enterprise has placed these products in our retail market and we would suggest that readers might give them a trial before again purchasing imported tea or coffee.

Rubber Seed and its Oil.

At least two attempts have been made in recent years to convert to commercial use the annual crop of rubber seed produced in Malaya.

On the face of it, it would appear reasonable to suppose that such a venture has a chance of success in view of the fact that the seed is a by-product of the industry, at present neglected except for the very small demand for seed for planting purposes. The only expenses involved are in the collection and transport of the seed to factory and cost of expressing and marketing the oil.

We believe that the first venture failed largely on account of unsuitable machinery and consequent deterioration of the seed before it could be treated. The second attempt involved the shipment of the seed to the Netherlands Indies before treatment. While we have no precise information on the causes of the

cessation of this enterprise, it is not unlikely that the seed was found to have deteriorated before it could be dealt with on arrival.

The period of seed production is a very short one, which involves a choice of the mill being able to preserve the seed in order to keep the plant working regularly, or to mill rubber seed during its season and to have other seeds to mill during the period when no rubber seed is available.

It is probable that the amount of rubber seed produced in Malaya approximates to 250,000 tons, a potential source of about 60,000 tons of oil. The increasing practice of cultivating cover crops with rubber, and of selective weeding, precludes such areas for the collection of seed, but there must still remain considerable areas where seed collection would be possible.

The authors of the article in the present number of this Journal record the results of their experiments designed to determine the nature of the deterioration of stored rubber seeds and possible methods of preserving the seed so that it may be available as the mill requires it. They also record the characteristics of the oil and of the resultant meal and conclude with remarks on the industrial possibilities of the oil.

The conclusion arrived at by the authors is that the seed must be collected at frequent intervals. Under good conditions of storage, it will keep for about four months after which time there is a rapid increase of acidity in the oil. If the kernels are stored under conditions that allow of no increase in humidity, the oil shows no tendency to increase in acidity.

It is concluded that only seasonal milling of the kernels would be likely to be profitable, the collection and treatment of a supply of kernels sufficient to keep even a small mill working during the whole year being out of the question. The possibility of establishing rubber seed oil on the vegetable oil market depends on the price of linseed oil, so that as long as the latter oil, with its markedly superior drying properties, is available at a cheap price, it is unlikely that rubber seed oil, with its limitations as regards collection of seed and treatment of kernels, will become a market commodity.

Pineapple Bran.

Yet another possible by-product of a local industry receives consideration in an article on "The Preparation and Disposal of Pineapple Bran," which has been prepared at our request by the British Consul at Honolulu to whom we tender our thanks.

The pineapple factories in Malaya are frequently much embarrassed on account of the accumulation of enormous quantities of waste pineapple material, the retention near the factories of which must be considered unhygienic, while its disposal in some instances involves considerable expense.

The preparation of pineapple bran from this waste has been developed by the Hawaiian packers. It offers at least a partial solution to this problem, although it must be remembered that, even in Hawaii, there is a present difficulty in disposing of all the bran, due probably not only to the general trade condition, but also to the rapid increase in production.

The Malayan packer would be well advised to consider the possible market for the bran before embarking on a considerable outlay of machinery for its preparation.

The quantity of live stock in Malaya is not large and a suitable concentrated food is already produced locally in "poonac", the residual cake from the extraction of oil from copra. A large production of pineapple bran might well injure this established local production of poonac, in which case the country would not benefit in any way by the introduction of a locally prepared pineapple bran.

Nevertheless, the disposal of pineapple waste remains a problem which might be solved by its conversion to pineapple bran.

Another possible method of disposal of pineapple waste is as a manure for pineapple cultivation. We are prompted to throw out this suggestion as results show that, except on virgin land, pineapples cannot be grown successfully in Malaya without the application of manure.

This possible solution has much to recommend it. The waste has first to be reduced to a suitable form. This subject has already been investigated by this Department and the results published in Vol. XV of this Journal under the title : "Bye-products of the Pineapple Canning Industry." As pineapple factories are generally in the vicinity of the source of supply, transport costs should not be excessive.

Doubtless the last has not been heard on the subject of disposal of pineapple waste, but there is now considerable data available upon which a policy may be constructed.

Original Articles.

AGRICULTURAL POSSIBILITIES OF CAMERON HIGHLANDS FOR THE PROPRIETARY PLANTER AND SMALL-HOLDER

BY

B. BUNTING,

Agriculturist.

Introductory.

With the completion of the road from Tapah to Cameron Highlands considerable interest is now being evinced regarding the agricultural possibilities of the Highlands, principally from the point of view of the proprietary planter and small-holder.

In January, 1926 the Department of Agriculture commenced work on the opening up of an experimental plantation at Tanah Rata. Although good progress has been made in connection with the development of this plantation, the work was severely handicapped in the early stages owing to the absence of communications, but in spite of this, it has shown that a number of crops can be grown with success on the Highlands.

Situation.

Cameron Highlands proper comprises a comparatively small tract of country lying in the extreme north-west corner of Pahang situated at an elevation of 4,600 to 5,200 feet, which is bounded on the east and north respectively by the States of Perak and Kelantan.

The Highlands are approached by road from Tapah *via* Jor, Renglet and Lubok Tamang, the distance from Tapah to Tanah Rata being approximately 40 miles.

Tanah Rata, which is the southernmost part of the Highlands proper, is situated at latitude 4° 28″ North and longitude 101° 23″ East.

Topography.

The general lie of the country is naturally hilly, but there are numerous small portions of undulating land scattered throughout the Highlands which may be found suitable for the cultivation of annual crops. There is very little flat land to be found on either the Southern or Northern Highlands.

After leaving Tapah the road follows the Batang Padang valley and from about the 4th. mile ascends steadily until the Perak-Pahang boundary is crossed at 3,700 feet. The road from this point descends into Renglet and passes through an undulating strip of country known as Lubok Tamang (3,250 feet) until it

reaches Kuala Habu. At this point the road begins to rise again until it reaches the 37th. mile, (4,750 feet) and then falls to about 4,600 feet at Tanah Rata.

Climate.

The following is a brief summary of the meteorological readings taken at Tanah Rata (4,640 feet) for the period 1924 - 1931, which will give a good indication of the climatological characteristics prevailing on the Highlands.

Temperatures.—The mean maximum air temperature is 72°F. (highest mean maximum 74° and lowest mean maximum 70°), while the mean minimum is 56° (highest mean minimum 59° and lowest mean minimum 55°). The warmest day was 79° in April and the coldest night 42° in both January and February, while the coldest day was 63° in October, November and December and the warmest night 68° in April.

Although the seasonal changes of temperature are small they are greater than any found on the plains and the average daily maximum temperature is found to be lowest from October to February. The night minimum is, however, much the same throughout the year with a difference of only 4° between the highest and lowest mean minimum.

Rainfall.—The average rainfall for the year over the period under review was 107.8 inches, the wettest month being October with an average precipitation of 13.7 inches and the driest month July with 4.1 inches. The greatest rainfall in a day was 6.3 inches, which was recorded in December, 1926 during the notorious floods in Pahang. It will be seen from these figures that the rainfall is somewhat low compared with other Hill Stations in the country, which is a decided advantage from an agricultural standpoint. The period September/December comprises the wettest months of the year, while there are marked dry intervals during January/March and June/July, which is much the same as on the plains.

Sunshine.—The average daily total of bright sunshine is 4.38 hours. The brightest month is July with 5.45 hours of sunshine per day and the dullest month is December with an average of only 3.32 hours per day. Although the sunshine is fairly evenly distributed the longest days' sunshine occur in the middle part of the year.

Experimental Plantation.

The Government Experimental Plantation at Tanah Rata is situated at the extreme South-east corner of the Highlands at an average elevation of 4,750 feet. The low-lying portion adjoining the Sungei Bertam is about 4,640 feet, while the highest areas cleared for planting is approximately 4,850 feet above sea-level.

The Plantation is sheltered by the surrounding mountain ridges, which include Gunong Berembun (6,036 feet) on the eastern side and Bukit Mentigi (5,120 feet) on the western side with Gunong Jasar (5,565 feet) and Gunong Ruil (5,680 feet) situated more distant in north-westerly direction.

As previously stated, work on the opening up of the Experimental Plantation

at Tanah Rata was commenced in January, 1926, at which time there were only about 12 miles of road leading up to the Highlands from Tapah.

The opened area of the Plantation is approximately 200 acres, but only about half this area has been planted up so far. It is the policy to open up the land on the Highlands a year or so ahead of requirements so as to allow of the removal of all valuable timber and at the same time economise on clearing and burning the partially dried stumps.

An area of about 100 acres has been planted up with tea, coffee, cinchona, cardamoms and numerous other crops which are likely to prove suitable for cultivation under the conditions obtaining on the Highlands.

At present there are about 40 acres under various jats of tea and a small tea factory has now being erected on the Plantation so that experiments may be carried out in the manufacture of upland tea.

Arrangements have also recently been made for a fully-trained Agricultural Officer to be stationed on the Highlands so as to be able to advise on the many agricultural problems which are likely to arise in connection with the future development of the Highlands. Mr. E. A. Curtler, Assistant Agriculturist, who visited Ceylon, India and Assam on a six months' tour to investigate agricultural conditions in those countries, has recently taken up his appointment and is now resident on the Experimental Plantation at Tanah Rata.

Visitors to the Highlands who are interested in agricultural matters are invited to inspect the Plantation by arrangement with the resident Agricultural Officer in charge.

Agricultural Possibilities on the Highlands.

In making a survey of the agricultural possibilities of the Highlands one must consider the suitability of the soil and climate for a particular crop in addition to finding a ready and profitable market for the produce when the crop matures.

The following is a brief summary of the crops which are under trial at the Experimental Plantation, Cameron Highlands and have so far shown promising results on a small experimental scale.

Tea.

There are at present about 40 acres planted with different jats of tea introduced from Assam and the growth to date has been most promising. The greater portion of this area was planted in 1928 so is only just coming into bearing.

The original area of Assam and Manipuri tea (Dangri, Dhonjan and Rajghur "jats") planted in January, 1926 with one-year old stumps continues to make excellent growth and is giving good yields. This area comprises about 430 bushes planted 4 ft. x 4 ft., which gives 2,722 plants per acre. Plucking commenced on the 27th. July, 1927, i.e. 2½ years from sowing the seed, and the calculated yields of dry tea per acre were 470 lbs. for the first plucking year with a plucking

round of 9 to 10 day intervals. Subsequent records indicate that a yield of over 600 lbs. of dry tea per acre may be expected under normal conditions.

Although samples of hand-made tea have been submitted for examination and favourably reported on in most cases, it will not be possible to ascertain the true quality of the tea until it has been manufactured under properly controlled conditions in the experimental tea factory now in course of erection at the Plantation.

The prospects for tea cultivation on the Highlands are distinctly promising as both soil and climate appear suitable for the production of upland tea for export, apart from satisfying the local demand for good quality tea.

The only drawback is that the cultivation of tea requires a large capital outlay and would require an area of at least 150 acres to warrant the erection of a small factory for the preparation of first-class tea. This difficulty might, however, be overcome to a certain extent by planting up contiguous small areas of 100 acres or more and arranging for the tea to be manufactured in a central factory under properly supervised conditions.

Arabian Coffee.

A small consignment of seed of Kent's Arabian coffee was received from the Department of Agriculture, Mysore in February, 1928. The seedlings raised from this consignment of seed were planted out in the field during the early part of May, 1928, and an area of 6 acres was eventually established at different distances of planting. These bushes commenced flowering at about two years after planting and produced the first crop of fruit a year later.

The beans produced have the typical bluish green colour of mountain coffee, when freshly roasted and ground the prepared coffee possesses a fine aroma and excellent flavour which leaves little doubt as to its high quality.

Unfortunately the area has recently been infected with coffee leaf disease, *Hemileia vastatrix*, so that further observation and experiment is necessary before coffee growing can confidently be recommended on the Highlands.

Cinchona.

A small quantity of seed of both *Cinchona Ledgeriana* and *C. succirubra* was received from Java in October, 1926. This was sown in carefully prepared seedbeds on the 18th. November. Germination commenced on the 9th. December, 1926 and ended in March, 1927. At the end of that month the germinated seedlings were transferred from the seed beds to nursery beds. These seedlings were again transplanted in September, 1927 being spaced 6 inches apart in the nursery beds, which were lightly shaded with bracken.

During October/November, 1929 a large number of the seedlings were planted 4 feet apart on terraces, the vertical interval between the terraces being roughly 7 feet, while the Ledgeriana seedlings were planted 4 feet x 4 feet on unterraced land. At the present time there are approximately $2\frac{1}{2}$ acres of each species planted in the open. In addition there is about 1 acre of each type planted on

thinned out jungle to test the effect of shade on cinchona.

Samples of bark of both species taken from trees only three years old were sent to the Government Quinine Factory, Bengal, India for examination in June, 1930 and were very favourably reported on considering the trees are not yet fully developed.

The following figures show the analytical results of the samples in question :—

	C. Ledgeriana	*C. Succirubra.*
Quinine sulphate ...	10.53 per cent.	2.51 per cent.
Total alkaloids ...	9.40 „	7.31 „

The Government Quinologist in reporting on these samples stated "the quality is extremely high, but the bark most remarkably thin".

Although the preliminary results obtained with the cultivation of cinchona on the Highlands are distinctly encouraging, the extraction of the alkaloids from the bark and their subsequent purification would require a large outlay of capital so that cinchona is not a crop suitable for the proprietary planter with only a limited amount of capital at his disposal. Further, an area of a few hundred acres would be more than sufficient to supply the requirements of this country and it would be difficult to find an export market for any surplus produce owing to present over-production of quinine in Java.

Cardamoms.

The Department obtained a small supply of seed of both the Mysore and Malabar varieties of cardamoms from Ceylon during March, 1928 and both these varieties have been established. The planted area has been extended to about 4 acres with suckers obtained from the original Malabar plants. The plants of the Mysore variety have just reached the fruiting stage and judging by their behaviour to date, the cultivation of this crop may be attended with success, particularly at lower elevations in the sheltered valley of the Sungei Renglet and its tributaries (3,500 feet).

Fruits.

The climate and elevation of the Highlands are unsuitable for the successful cultivation of most temperate fruits.

A certain amount of success has been attained with a variety of strawberry introduced from the Philippines, although the fruits are somewhat small compared with the European varieties. Passion fruit flowers well on the Highlands and produces large quantities of fruit.

The thick-skinned citron also thrives exceedingly well at this elevation and fruits most freely all the year round. Other citrus cruits under trial include the orange, grape-fruit and the pomelo, but the trees are not yet sufficiently developed to produce fruit.

Rhubarb has also been successfully established from seed and appears to thrive on the Highlands.

Vegetables.

Excellent results have been obtained in the cultivation of vegetables, more especially at Renglet, where the soil conditions are probably more suitable.

The following vegetables have been grown from time to time with success :— lettuce, radish, green pea, beans, cabbage, cauliflower, carrot, beetroot, khol-rabi, turnip, Jerusalem artichoke, potato, leek, onion and tomato.

The demand for such vegetables on the Highlands will naturally be very limited until this Hill Station is more developed so that some other means will have to be found for the disposal of the produce. There may be a certain demand in some of the large towns such as Kuala Lumpur, Ipoh and Seremban, but the principal market would undoubtedly be Singapore, where the requirements of the shipping trade could be met to a certain extent.

There will always be some difficulty in disposing of the more perishable vegetables, such as lettuce, radish ,leeks, beans, etc., as they very soon become unsaleable and therefore demand a ready market. The less perishable vegetables, such as carrot, turnip, beetroot, potato and possibly cabbage would, however, withstand long distance transport much better and at the same time would not require to be disposed of so quickly.

The cultivation of potatoes appears to hold out the best prospects under this heading, but they would have to be grown in rotation with other annual crops to be successful.

Further, it should be stated that continuous and heavy rains at critical stages in the growth of vegetables is ruinous to the crop and in order to maintain regular supplies a certain amount of protection by glass frames will be necesary.

Ornamental Plants.

Numerous flowers, shrubs and ornamental trees have been grown at the Experimental Plantation with excellent results.

Most flowering annuals thrive well on the Highlands and several species of bulbous plants such as Agapanthes, Crinum, Watsonias, Moraeas and Montbretias are growing and flowering freely.

Roses are a great success and most satisfactory results have been obtained with imported plants of named varieties.

Several types of ornamental trees have been under trial and amongst those which thrive particularly well are *Cryptomeria japonica, Cupressus macrocarpa, C. knightiana, Grevillea robusta, Casuarina* spp. and *Pinus merkusii.*

A market might be found in the large towns for cut flowers, more particularly in Singapore, where fair quantities of flowers are imported from Java, and this demand could easily be met from the Highlands if necessary. Little or no demand for cut flowers can be expected from the Highlands, even when it becomes more developed, since the residents will easily produce sufficient for their own requirements.

Dairy Farming.

The keeping of cows for the production of milk offers certain possibilities, but owing to the steep nature of the land, grazing on a large scale would be impracticable. This difficulty could, however, be overcome to some extent by stall-feeding the animals with Guinea grass, which thrives exceptionally well on the Highlands and suitable pasture grass would probably be provided by Australian Blue Couch where grazing on a small scale is possible.

The breeding of milch cattle for distribution on the plains might be worthy of consideration in case the production of milk on a small scale was not found sufficiently remunerative.

Poultry.

The breeding and rearing of poultry would appear to offer distinct possibilities if conducted on proper lines and good types of pure-bred fowls were kept. Rhode Island Red and White Leghorn would be suitable breeds for egg production, while Light Sussex are good layers and provide a good type of table fowl, especially if caponised and properly fattened.

Poultry keeping is, however, a subject which requires special study and unless previous practical experience has been gained in this direction it is most desirable to start in a small way until the numerous difficulties have been successfully overcome.

The demand for fresh eggs and properly fattened table fowls, if sold at reasonable prices, should make this a profitable undertaking apart from the sale of pure-bred stock for breeding purposes.

Marketing.

The greatest problem of the proprietary planter and small-holder will be the marketing of his produce. The cost of transport and distribution charges, unless reduced to an absolute minimum, are likely to make all the difference between profit and loss on the sale of produce.

The present rate of transport on the Highlands is 25 cents per ton per mile for a full load so that the rate would be proportionately higher for part of a load. This difficulty might be overcome to a certain extent by several small-holders co-operating with a view to providing (*a*) their own means of transport and (*b*) a selling or distributing agent for the disposal of their produce.

Attention would also have to be given to the grading and packing of produce so that standard orders could be placed by the distributors. For instance, if a case of potatoes was ordered it would be implied that it meant 120 lbs. or whatever standard was adopted for the packing of this particular produce.

These may appear to be minor considerations, but it will require really good organisation to dispose of produce at profitable rates with the least possible delay, otherwise it may become unsaleable and have to be destroyed.

Terms of Alienation.

Annex. 'A'.

Lipis 203/31 : Phg. G. 241/31.

Annexure "A"

Terms of alienation of Building Lands in the **Northern Highlands.**

Premium :

$500 per acre or part of an acre;

Annual Rent :

$5 per acre.

Form of Title :

Lease for 99 years.

Express Conditions :

(i) The lessee shall submit plans with elevations sections and specifications of a detached dwelling house with all necessary offices out buildings sewers and drains to the Chairman, Sanitary Board, Cameron Highlands within 6 months from the date of occupation or of registration of title whichever is the earlier. Such plans shall be subject to the approval and signature of the Director of Public Works or an officer authorised thereto by the Resident before the commencement of any works upon the land hereby leased. Building operations shall not be commenced until such plans shall have been so approved.

(ii) The lessee shall erect upon the land hereby leased in a substantial and workmanlike manner with the best materials of their several kinds and in accordance with the plans elevations sections and specifications approved as aforesaid under the inspection of and to the satisfaction of the Director of Public Works or an officer authorised thereto by the Resident a detached dwelling house with all necessary offices out buildings sewers and drains and shall complete the same in all respects fit for occupation within 2 years from the date of occupation or of registration of title whichever is the earlier.

(iii) The lessee shall not make any alterations to any buildings at any time existing on the land hereby leased except in accordance with plans elevations section and specifications previously approved by the Director of Public Works or an officer authorised thereto by the Resident.

(iv) The lessee shall not erect or build or permit to be erected or built on the land hereby leased any buildings other than those specified in clauses (i) and (ii) above except in accordance with plans elevations sections and specifications previously approved by the Director of Public Works or an officer authorised thereto by the Resident.

(v) — — — — — — — — .

(vi) The lessee shall pay to the State a reasonable proportion of the expenses of making repairing maintaining and cleansing all drains used in common by the land hereby leased and other land adjoining or near thereto, the amount

so to be paid to be determined by the Director of Public Works or an officer authorised thereto by the Resident.

(vii) The lessee shall not without the consent in writing of the Resident use or permit the use of the said house or any other buildings that may during the said term be erected on the land hereby leased for the purpose of carrying on any trade or business or any purpose other than as a dwelling house.

Annex. 'B'.

AGRICULTURAL TERMS. GRANT.

Terms of alienation of lands for agriculture (excluding lands to be used solely for stock raising dairy farming and or the cultivation of vegetables and cattle fodder) in the Southern Highlands.

Premium :

$35/- per acre.

Annual Rent :

$1/- per acre for the first six years, and thereafter $4/- per acre.

Form of Title :

Grant in perpetuity.

Implied Conditions :

In according with section 36 of the Land Code, 1926.

Express Conditions :

(i) The land shall be used solely for the cultivation of tea, coffee, cinchona, cardamoms, for stock raising and dairying purposes and for the cultivation of food-stuffs to be approved by the District Officer for human consumption or for consumption by cattle or for any one or more of the said purposes, or for any further purpose or purposes which may be approved by the Resident by endorsement on the Grant.

(ii) Plans of all proposed structures on this land shall be submitted to the District Officer for approval prior to erection.

(iii) For the checking of soil scour the registered proprietor shall, to the satisfaction of the District Officer, construct and maintain upon the land hereby granted silt pits or contour terraces, and shall, if so required by the District Officer, plant and maintain cover crops for the same purpose.

(iv) The registered proprietor or proprietors will upon being called upon so to do execute a surrender to Government of so much land not exceeding 5% of the whole area hereof as may be required for the following purpose :—

Construction thereon of a public road, and the Government will after the registration of such surrender pay to the registered proprietor or proprietors compensation for disturbance or damage to improvements buildings or cultivated ground, resulting from such surrender.

The right to re-entry and forfeiture arising under section 37 of the land Code 1926 shall when it arises from breach of the foregoing condition be restricted so that no land in excess of 5% of the total area shall be liable to forfeiture.

Annex. 'C'.

SHORT TERM LEASE.

Terms of alienation of lands to be used solely for stock raising dairy farming and/or the cultivation of vegetables and cattle fodder.

Premium :

$2/- per acre.

Annual Rent :

$2/- per acre.

Forms of Title :

Lease for 15 years with the right of renewal if the conditions have been carried out to the satisfaction of the Resident with increased premium, and rent on renewal should the Resident see fit.

Implied Conditions :

In accordance with section 36 of the Land Code, 1926.

Express Conditions :

The land shall be used solely for one or more of the following purposes :—

Stock-raising.

Dairy-farming.

The cultivation of such food-stuffs for human consumption as may be approved by the District Officer. The cultivation of such food-stuffs for the consumption by cattle as may be approved by the District Officer.

(ii) Plans of all proposed structures on this land shall be submitted to the District Officer for approval prior to erection.

(iii) For the checking of soil scour the registered proprietor shall to the satisfaction of the District Officer construct and maintain upon the land hereby granted silt pits or contour terraces, and shall, if so required by the District Officer, plant and maintain cover crops for the same purpose.

(iv) The registered proprietor or proprietors will upon being called upon so to do execute a surrender to Government of so much land not exceeding 5% of the whole area hereof as may be required for the following purpose :—

Construction thereon of a public road and the Government will after the registration of such surrender pay to the registered proprietor or proprietors compensation for disturbance or damage to improvements buildings or cultivated ground, resulting from such surrender.

The right to re-entry and forfeiture arising under section 37 of the Land Code 1926 shall when it arises from breach of the fore-going condition be restricted so that no land in excess of 5% of the total area hereof shall be liable to forfeiture.

STORAGE OF RUBBER SEEDS

BY

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and
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Introductory.

The present article summarises the results of an investigation carried out during the past two years to determine the treatment to which rubber seeds should be subjected in order to preserve them, since it is well-known that the untreated seeds deteriorate rapidly on storage with a considerable development of acidity in the oil.

Storage is necessary on account of the seasonal nature of the harvest, the greater proportion of the crop falling within a short period, usually during the months of September and October. The secondary fall which occurs at the commencement of the wintering season, January—February, is unimportant, compared with the main crop.

Further, it is immaterial whether the nuts are being exported or expressed locally. In the former case the time taken in transit to port of destination may be regarded as a period of storage, while for a local oil mill, relying upon rubber seeds, it would certainly be necessary from the point of view of economical working to arrange for a year's supply of seed. The seasonal milling of rubber seeds would only be profitable, provided they could be alternated with other oil-bearing seeds.

With regard to the utilisation of rubber seeds both the oil and cake have potential commercial values. Rubber seed oil, which belongs to the same class as linseed oil, possesses drying properties and can be used, for example, in the preparation of paints, while it has been shown that the cake remaining after expression of the oil forms a valuable feeding-stuff for cattle.

Although belonging to the same class as linseed oil, rubber seed oil is definitely inferior in drying properties, so that it is unlikely to replace that oil to any extent, unless the price of linseed oil is high. There are, however, other uses to which drying oils may be put and in which, for example, an inferior drying oil, such as rubber seed oil, might be preferable. There is little doubt, therefore, that, provided high quality oil could be produced in large quantities at a suitable price, rubber seeds would become established as a market commodity.

Composition of Seed.

The rubber seed consists of approximately 40 per cent. of shell and 60 per cent. of kernel, the variations found in the proportions of these two constituents

being dependent on the freshness of the seed. For example, in the freshly-fallen seed when the moisture content of the kernel may be as high as 35 per cent., the proportions approximate to 37 per cent. of shell to 63 per cent. of kernel, although for seed, which has been allowed to dry for a few days, there is a higher proportion of shell, consequent upon the more rapid drying of the kernel.

The following table gives the results of analysis of a sample of partially dried seed taken during the preparation of the samples for storage.

Seed		per cent.
Proportion of shell	...	42.4
Proportion of kernel	...	57.6
		100.0
Kernel		
Moisture (loss at 100°C.)	...	14.7
Oil (petroleum ether extract)	...	44.6
Residue (by difference)	...	40.7
		100.0
Oil (calculated on moisture-free basis)	...	52.3
Oil (calculated on seed)	...	25.7
Acidity of oil (calculated as oleic acid)	...	0.8

Consideration of Results of Analysis.

The results of analysis indicate that decortication is advisable on account of the large proportion of shell, the kernels occupying considerably less space than the seeds.

The high moisture content of the kernel necessitates drying in order to prevent increase in acidity of the oil as a result of the development of mould consequent upon the storage of moist oily material.

The oil content of the kernels is relatively high. The figure, calculated on a moisture-free basis, is slightly in excess of 50 per cent., which corresponds to approximately 25 per cent. on the seed.

Rubber seed kernels compare favourably as regards oil content with other well-known oil seeds, for example, palm kernels, groundnuts or gingelly, in all of which the figure for the oil content is of a similar order.

Although the acidity of the oil is low, being slightly less than 1 per cent., calculated as oleic acid, other experimental pressings carried out with freshly-gathered seeds have yielded oils with acidities less than 0.5 per cent. This indicates that the oil in the freshly-fallen seed is practically neutral.

It may be mentioned here that there is associated with the kernel an enzyme or non-organised ferment, which, owing to its power of splitting the oil into

glycerine and free fatty acids, is responsible to a certain extent for the increase of acidity in the oil of stored untreated kernels.

In addition to the enzyme the kernel also contains a cyanogenetic glucoside, that is a compound, which decomposes either as a result of enzyme action or in a very slightly acid medium yielding hydrocyanic acid (prussic acid) as one of the products. The faint smell of this acid noticed with moist fresh kernels, especially when they are heated, is evidence of the presence of this compound.

The hydrocyanic acid content of the kernels diminishes rapidly during the first week of storage as the figures in the following table, Table I, show. After that period the decrease is much more gradual, the amount present appearing to be approximately proportionate to the moisture content of the material.

TABLE I

Hydrocyanic Acid Content of Rubber Seed Kernels.

Period of Storage. weeks	Moisture Content. per cent.	Hydrocyanic Acid Content. per cent.	Hydrocyanic Acid Content. (calculated on moisture-free basis) per cent.
Fresh	35.9	0.077	0.120
1	29.0	0.016	0.023
3	12.7	0.015	0.017
4	11.4	0.011	0.013
14	6.5	0.006	0.006
20	8.1	0.006	0.007

The amount of hydrocyanic acid in fresh kernels appears to vary within fairly wide limits, as much as 0.223 per cent., calculated on a moisture-free basis, having been recorded.

Outline of Experiments.

As far as oil seeds are concerned both enzyme action and excess of moisture favour the development of acidity, the first by reason of direct chemical action on the glycerides composing the oil, while the storage of moist oil seeds, especially under local conditions, results in mould growth, which in turn causes decomposition of the oil.

As explained previously, the rubber seed kernel contains an enzyme, while the moisture content of the fresh kernel is also high, so that when laying down the experiments the treatment was varied so as to study the effect of both these factors on the storage qualities of the kernels. In this connection it may be mentioned that kernels were used in all the experiments, the freshly-gathered seeds being first decorticated by hand.

Since enzyme action may be inhibited by sterilising the material, in those experiments in which it was necessary to eliminate deterioration owing to this

cause the kernels were first treated in a closed vessel with steam under pressure.

As regards drying this was effected in a few instances by exposure to the sun. In the majority of the experiments the kernels were heated in a hot-air drier at a temperature of approximately 40°C. in order to reduce the moisture content to the required figure. It is considered that artificial drying is preferable, especially if the seeds are being treated on a commercial scale. Even in the dry season sun-drying is unreliable, and further, since the main rubber seed harvest coincides with the advent of the long wet season the chances of satisfactory sun-drying on a large scale are rendered still more remote.

Approximately 7 lbs. of kernels were used in each experiment. The kernels were stored in small sacks either hung inside a wire cage or suspended from the roof of the Experimental Factory so as to prevent rats from attacking the material. The sacks were sterilised previously with high pressure steam in order to free them from any insect pests. Samples of the kernels were removed for testing from time to time in accordance with the programme for the particular experiment.

As will be seen later, the kernels were badly attacked by insects. The material was examined by the Government Entomologist, who reported the presence of two beetles, *Carpophilus* sp. and *Silvanus advena*. It is understood that both these beetles are found whenever seeds, especially soft oil seeds like rubber seeds, are stored for any length of time. The former beetle, *Carpophilus* sp., also occurs with copra, while *Silvanus advena* is often found in stored rice.

Since it was thought that part of the increase in acidity might be due to this cause, in the second series of experiments the additional precaution was taken of enclosing the sack inside a fine muslin bag in order to prevent insect attack.

On account of the tendency of the material to become mouldy, which in turn causes decomposition of the oil, in some experiments the kernels were cut in half in order to ascertain whether this tendency would be increased owing to exposure of the interior of the kernel. It will be realised that while unbroken kernels were used in the experiments, mechanical decortication is bound to result in a proportion of the kernels being damaged with consequent exposure of the flesh to the air.

In order to obviate the effect of varying conditions of atmospheric humidity on the kernels during storage, which might reasonably be expected to affect mould growth, arrangements were made with the Electrical Board for the storage of 4 sacks of kernels at Bungsar Power Station. The sacks were stored in a warm, dry place where the minimum temperature did not fall below (30°C.) 86°F., while the maximum approximated to (37°C.) 98.5°F. Under these conditions a gradual desiccation of the kernels occurred, since the minimum temperature was only slightly less than the maximum atmospheric temperature.

The figure for the acidity of the oil was taken as a criterion of the storage qualities of the kernels, determinations of acidity being carried out on the oil obtained by expression. Approximately 1 lb. of kernels was removed on each

occasion, crushed between rollers, the resultant meal being warmed and pressed in the small laboratory hand-press.

Details of Experiments.

(*a*) *Untreated Kernels and Sterilised Kernels.*

Sacks of untreated kernels and sterilised kernels were stored for a period of two months. The kernels were sterilised with steam at a pressure of 30 lbs. per square inch for a period of 15 minutes and dried in the air for one day before placing in the sacks.

At the conclusion of the period of storage the results of examination showed that in both cases the kernels were mouldy, inside and outside, while in addition they had been attacked by insects.

In the case of the untreated kernels the acidity of the oil, calculated as oleic acid, was found to be 26.8 per cent., while that from the sterilised kernels was 17.9 per cent.

The results of the experiments show therefore that untreated kernels developed acidity rapidly on storage, while sterilisation alone is insufficient to prevent such development.

The acidity of the oil from the sterilised kernels is much too great to allow of the oil being used for high grade commercial purposes.

(*b*) *Sterilised and Dried Kernels.*

(i) Owing to the unsatisfactory results obtained by sterilisation alone another series of experiments was carried out in which the kernels, after being sterilised with steam at a pressure of 30 lbs. per square inch for a period of 30 minutes, were sun-dried for one week before storage. The moisture content of the kernels was approximately 8 per cent. Samples of the stored kernels were taken for analysis at intervals of two months, the results being shown in the following table, Table II.

TABLE II

Sterilised and Dried Kernels (First Series).

Period of Storage. months	Acidity of Oil. (calculated as oleic acid) per cent.	Condition of Kernels.
2	0.2	Free from mould. Few insects.
4	3.3	Mouldy outside, about 35 per cent. mouldy inside. Few insects.
6	21.2	Mouldy outside, about 65 per cent. mouldy inside. Badly attacked by insects.

The results of this series of experiments indicate that, provided the kernels are sterilised and dried, it is possible to store them for a period of approximately four months without any marked increase in the acidity of the oil.

The rapid increase in the acidity of the oil after four months' storage is remarkable and would appear to be due to a combination of mould growth and insect attack.

(ii) In view of the interesting results obtained, a further series of experiments was laid down both to confirm the remarkable increase in acidity of the oil after four months' storage, also to ascertain the extent to which the increase could be attributed to the action of moulds or insect attack.

The kernels were sterilised with steam at a pressure of 30 lbs. per square inch for a period of 30 minutes, after which they were dried in the hot-air cupboard for approximately 12 hours, until the moisture content had been reduced to approximately 6 per cent. In two instances the kernels were cut in half immediately after decortication in order to ascertain whether exposure of the interior of the kernel was also likely to increase the tendency to development of acidity.

Two sacks, containing whole kernels and half kernels respectively, were suspended from the roof of the Experimental Factory, while two other sacks, each enclosed in a muslin bag as previously mentioned to prevent insect attack, were stored in a cupboard.

In order to obtain a better indication of the rate of development of acidity samples of kernels were drawn for analysis at the end of every six weeks instead of every two months as in the first series of experiments.

Further, in order to ascertain the extent to which the moisture content of the kernel varied on storage, moisture determinations of the meal obtained prior to expression were also carried out.

The results of analysis are shwon in Table III, page 170.

In general therefore it may be said that the results confirm those obtained in the original series regarding the rapid increase in acidity of the oil after approximately four months' storage.

It is considered that the increase in the moisture content of the kernel during the first twelve weeks of the experiment can be attributed to the wet weather prevailing during the last three months of the year, the period of storage having commenced during the second week of the month of September.

Also it will be noticed that with the drier weather prevailing during the month of January there is a distinct tendency for the moisture content of the material to diminish.

The figures for the moisture content of the kernels indicate therefore that the material is susceptible to changes in atmospheric humidity. Further, there is no doubt that an increase in the moisture content can be correlated with both increased mould development and insect attack, the latter being the more potent factor as far as acidity is concerned.

It is interesting to note that there is practically no difference between the storage qualities of whole kernels and half kernels.

Table III

Sterilised and Dried Kernels (Second Series).

Details of Storage	Period of Storage. weeks	Moisture Content of Kernel. (approx.) per cent.	Acidity of Oil. (calculated as oleic acid) per cent.	Condition of Kernels.
Whole kernels stored in sack.	Fresh	6.7	0.2	
	6	8.5	0.6	Few insects. Slight mould.
	12	7.6	2.4	Few insects. Slight mould.
	18	5.6	9.4	Badly attacked by insects. No mould.
	24	8.1	18.9	Insect-ridden.
Half kernels stored in sack.	Fresh	5.1	0.1	
	6	8.4	0.7	Few insects. Slight mould.
	12	8.5	2.8	Few insects. Slight mould.
	18	5.7	11.0	Badly attacked by insects. No mould.
	24	7.9	23.9	Insect-ridden.
Whole kernels stored in sack enclosed in muslin bag.	Fresh	6.0	0.2	
	6	9.0	0.7	Good condition.
	12	9.3	1.6	Very few insects. Mouldy.
	18	7.7	10.6	Very few insects. Mouldy.
	24	7.1	12.9	Very few insects. Mouldy.
Half kernels stored in sack enclosed in muslin bag.	Fresh	5.3	0.2	
	6	8.7	0.6	Good condition.
	12	8.9	2.1	Very few insects. Mouldy.
	18	6.7	7.2	Few insects. Mouldy.
	24	7.4	12.7	Insects developing. Mouldy.

As regards the actual loss of material suffered during the period of storage, results show that insect attack is much more serious than mould development. Kernels stored in sacks in the Experimental Factory lost approximately 20 per cent. by weight of material, calculated on a moisture-free basis, while those stored in the cupboard only lost approximately 10 per cent.

It may be mentioned here that, although a few insects succeeded in entering the sacks through the folds of the muslin it is not considered that they were sufficient in number to invalidate the general conclusions stated above.

(iii) Since it was thought that the initial moisture content of the kernel might have an influence on the storage qualities, an additional series of experiments was laid down in which the moisture content was only reduced to approximately 8 per cent. The results were, however, similar to those given in (ii) above so that it is not considered necessary to furnish details.

(*c*) *Dried Kernels.*

On account of the additional expense involved in sterilisation, a further series of experiments was carried out to ascertain whether drying of the kernels was as efficacious as combined sterilisation and desiccation.

TABLE IV

Dried Kernels.

Details of Storage.	Period of Storage. weeks	Moisture Content of Kernel. (approx.) per cent.	Acidity of Oil. (calculated as oleic acid) per cent.	Condition of Kernels.
Whole kernels stored in sack.	Fresh	3.9	0.1	
	6	8.8	1.4	Good condition.
	12	9.7	4.5	Insect attack commencing. Mouldy.
	18	6.1	16.3	Badly attacked by insects. Slight mould.
	24	6.3	24.3	Insect-ridden.
Half kernels stored in sack.	Fresh	5.1	0.2	
	6	8.7	1.5	Good condition.
	12	9.1	3.6	Insect attack commencing. Mouldy.
	18	5.0	14.8	Badly attacked by insects. Slight mould.
	24	6.0	29.4	Insect-ridden.
Whole kernels stored in sack enclosed in muslin bag.	Fresh	4.9	0.3	
	6	8.6	1.4	Good condition.
	12	10.7	3.6	Very few insects. Mouldy.
	18	7.3	10.0	Few insects. Mouldy.
	24	6.4	17.3	„
Half kernels stored in sack enclosed in muslin bag.	Fresh	4.2	0.2	
	6	8.6	1.3	Good condition.
	12	9.3	2.5	Very few insects. Mouldy.
	18	6.9	9.4	Few insects. Mouldy.
	24	6.5	21.2	Badly attacked by insects. Mouldy.

The decorticated kernels, whole and cut in half, were dried in the hot-air cupboard at a temperature of 40°C. until the moisture content of the material had been reduced to between 4 and 5 per cent.

The conditions of storage were similar to those described in the second series for sterilised and dried kernels, the results of the experiments being shown in Table IV, page 171.

The results of this series of experiments also confirm the rapid increase in acidity of the oil taking place after approximately four months' storage.

A similar tendency for the moisture content of the material to increase during the first half of the period of storage is also noticeable.

With regard to the first part of the period of storage, it will be seen that drying alone is not quite so effective as both sterilising and drying, the figures for the acidities of the oils in the various experiments being slightly higher than those in the corresponding series given previously.

The high figure for the acidity of the oil from the half-kernels in the last experiment was due to a defect in the muslin bag, which was not discovered until the bag was opened on the conclusion of the storage period.

(d) Sterilised and Dried Kernels at Bungsar Power Station.

Arrangements were made for the storage of 4 sacks of kernels at Bungsar Power Station under special conditions so as to obviate any effect due to varying conditions of atmospheric humidity.

TABLE V

Sterilised and Dried Kernels at Bungsar Power Station.

Details of Storage.	Period of Storage. weeks	Moisture Content of Kernel. (approx.) per cent.	Acidity of Oil. (calculated as oleic acid) per cent.	Condition of Kernels.
Whole kernels stored in sack.	Fresh	7.6	0.4	
	6	3.1	0.4	Good condition.
	12	4.1	0.3	Do.
	18	3.2	0.3	Do.
	24	3.3	1.0	Do.
Half kernels stored in sack.	Fresh	6.7	0.4	
	6	2.9	0.5	Good condition.
	12	3.8	0.2	Do.
	18	3.2	0.2	Do.
	24	3.2	0.6	Do.
Whole kernels stored in sack enclosed in muslin bag.	Fresh	8.6	0.5	
	6	2.9	0.3	Good condition.
	12	3.8	0.2	Do.
	18	3.2	0.2	Do.
	24	3.0	0.5	Do.
Half kernels stored in sack enclosed in muslin bag.	Fresh	6.0	0.5	
	6	3.1	0.3	Good condition.
	12	4.0	0.2	Do.
	18	3.1	0.3	Do.
	24	3.3	0.7	Do.

The kernels were sterilised and dried to a moisture content of approximately 7 per cent. before storage, the details of the experiments being as given previously. The results are given in Table V, page 172.

The results of the experiments show that, provided the treated kernels are stored under conditions which do not allow of changes in atmospheric humidity affecting the material, the oil shows practically no tendency to increase in acidity, even after six months' storage.

It will be noticed that in only one instance the acidity of the oil has risen to 1 per cent. The irregular figures for acidity obtained in the early stages of the various experiments are only to be expected when estimating acidities of oil of such a low order expressed under factory conditions.

Characteristics of Rubber Seed Oil.

Although this article is concerned with investigations on the storage qualities of rubber seeds it is not considered out of place to refer briefly to the characteristics of the oil, especially as reference has already been made to its utilisation.

Rubber seed oil is light yellow in colour when freshly prepared and has an odour somewhat resembling linseed oil. A darker coloured oil is obtained from the stored seeds, while the oil itself darkens on keeping. In this connection it may be mentioned that, although the kernels when sterilised and dried darken slightly during such treatment, especially when sterilised with high pressure steam, the colour of the oil is scarcely affected.

The constants of the oil are shown in the following table, average figures for linseed oil being added for purposes of comparison :—

	Rubber Seed Oil	Linseed Oil (Average)
Oil.		
Specific gravity at 30°C (water at 15°C = 1)	0.9163	0.934 (15°C)
Retractive index at 30°C	1.4690	1.4758
Saponification value	194.2	192.0
Iodine value (Wijs)	137.1	170—190.
Acidity (oleic acid per cent.)	1.5	3.0 (maximum)
Unsaponifiable (per cent.)	1.0	1.5
Fatty Acids.		
Solidifying point (Titer value)	28.4°C	17°—24°C
Mean molecular weight	284.5	
Iodine value (Wijs)	139.4	

The results indicate that the normal acidity of linseed oil is low. If, therefore, rubber seed oil is to compete it would be necessary to take such precautions as to ensure an oil of similar quality. This would involve the treatment of the freshly collected seeds without delay.

The figure for the iodine value, which is regarded as a measure of the drying properties of the oil, shows the inferiority of rubber seed oil to linseed oil in these respects.

Rubber Seed Kernel Meal.

In view of the large number of experimental pressings carried out in connection with the preparation of the necessary samples of oil for acidity determinations, advantage was taken to analyse a sample of the solvent-extracted meal in order obtain analytical data for such material.

The results of analysis are shown in the following table, average figures for extracted linseed meal being added for purposes of comparison :—

	Rubber Seed Kernel Meal		Linseed Meal (Extracted)	
		Moisture-free basis		Moisture-free basis
	per cent.	per cent.	per cent.	per cent.
Moisture ...	11.0	—	10.2	—
Ash ...	4.7	5.3	6.8	7.6
Oil ...	—	—	3.8	4.2
Crude Protein ...	33.6	37.8	37.4	41.7
Crude Fibre ...	3.4	3.9	9.1	10.1
Carbohydrate (by difference)	47.3	53.0	32.7	36.4
	100.0	100.0	100.0	100.0
Phosphate as P_2O_5 ...	1.4	1.6	—	—
Potash as K_2O ...	2.1	2.3	—	—

The results of analysis show that rubber seed kernel meal is rich in crude protein, while it is low in crude fibre. As regards the crude protein content it will be seen that the meal approaches in composition to linseed meal, although the figure for the crude fibre is considerably less.

Experiments showed that the meal from stored kernels still contained a small amount of the cyanogenetic glucoside, to which reference has already been made. For example, in the meal from kernels stored for 18 weeks the amount of hydrocyanic acid was found to be of the order 0.01—0.02 per cent.

Rubber Seed Shells.

Assuming that the kernels were being dried artificially, supplies of fuel would be necessary, in which case there is no doubt that the shells obtained on decortication would be used.

An analysis was therefore made of the fresh shells in order to ascertain the value of the material from the point of view of plant nutrients, although it is realised that by burning the shells the whole of the nitrogen would be lost. The results are given in the following table :—

		per cent.	Moisture-free basis per cent.
Moisture	...	12.32	
Ash	...	0.33	0.38
Nitrogen	...	0.26	0.30
Phosphate as P_2O_5	...	0.004	0.005
Potash as K_2O	...	0.085	0.097.

The results of analysis show therefore that the fertilising value of the ash is not great. The percentage of ash is low, while the percentages of phosphate and potash in the ash are only 1.3 per cent. and 25.6 per cent respectively.

Remarks and Conclusions.

The results of the investigation show that in order to preserve rubber seeds against development of acidity in the oil the seeds should be collected frequently and treated without delay.

Frequent collection is essential, since the main harvest coincides with the arrival of the long wet season and if the seeds are left lying on the ground for any length of time during such weather there will be a marked increase in the acidity of the oil.

It is shown that under normal conditions of storage the kernels from freshly collected seeds after treatment can be preserved for a period of approximately four months without any marked increase in the acidity of the oil. Treatment of the kernels involves either combined sterilisation and drying or merely drying, the combined treatment giving slightly better results.

Partly on account of the soft texture of the kernel and partly on account of the changes in humidity, the material is liable both to mould development and insect attack. The results become marked after approximately four months, when there is such a considerable increase in the acidity as to render the oil unsuitable for high grade commercial purposes.

As a result of mould development and insect attack there is a considerable loss of material. With severe insect attack the amount may be as much as 20 per cent., but with mould development only 10 per cent. The oil content of the material does not appear to be markedly affected.

If the treated kernels are stored under conditions that do not allow of increase in humidity, the oil shows no tendency to develop acidity.

Possibilities of Rubber Seed Oil Production.

Although with the abnormally low prices now prevailing for oil seeds there is no chance of any development as regards the utilisation of rubber seeds it must be remembered that the experiments were commenced two years ago when several enquiries were received regarding the possibilities of the oil. The following remarks must be taken therefore as applying to normal conditions.

Seed collection would have to be restricted to clean-weeded estates, since on account of the size of the seed it would be uneconomical to consider collection on any estate where there was a cover-crop.

From the point of view of local treatment, the results of the storage experiments indicate that only seasonal milling of the kernels would be likely to be profitable, the collection and treatment of a supply of kernels sufficient to keep even a small mill working during the whole year being out of the question.

The kernel store should be clean and well-ventilated so that in the relatively short period during which it is possible to store kernels without any marked increase in acidity of the oil the effects of mould development and insect attack may be reduced to a minimum. The rubber seed kernel with its soft texture would appear to be specially influenced by these two factors.

No comments can be offered on the possibilities of exporting the treated kernels in sacks, although there would appear no reason to expect any considerable increase in acidity during transit, provided the treatment had been adequate and sacks free from insects had been used for packing.

As stated previously, the possibility of establishing rubber seed oil on the vegetable oil market depends on the price of linseed oil so that as long as the latter oil, with its markedly superior drying properties, is available at a cheap price, it is unlikely that rubber seed oil with its limitations as regards collection of seed and treatment of kernels will become a market commodity.

In conclusion, the writers wish to thank the Chairman of the Electrical Board, F.M.S. and Mr. P. A. Bray, Superintendent, Bungsar Power Station, for their kindness in granting storage facilities.

AGRICULTURAL COMMODITY VALUES IN MALAYA 1931

BY

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During the year 1931, Malaya experienced an unprecedented decline in the export values of the agricultural products upon which the prosperity of the country so largely depends.

The effect of this decline in prices was felt not only in the sale of the agricultural products of Malaya, but in the very considerable trade in the agricultural products of neighbouring countries which are shipped to Singapore in particular, where they are regraded and converted to a condition suitable for the world's markets.

The main agricultural exports of Malaya are rubber, coconut products, canned pineapples, tapioca, arecanuts, oil palm products, sago and hides and skins.

The production of rubber in Malaya 1931 is estimated at 434,857 tons, as compared with 435,063 tons in the previous year. The average unit value, however was 50 per cent. less than in 1930.

The net exports in 1931 of the remaining agricultural products stated above were 242,122 tons, being but 2,012 tons, or 1 per cent. less than the preceding year. The total value of the net exports of such products in 1931, judged on the declared trade values of imports and exports as published officially, was $26,629,817, being $10,856,645, or 29 per cent. less than in 1930. The details are given in the Table which follows :—

TABLE I.

Net quantity and Value of Principal Agricultural Exports of Malaya 1930 and 1931.

(Excluding rubber)

PRODUCT.	1930		1931	
	Quantity tons.	Value $	Quantity tons.	Value $
Coconut Products ...	121,965	18,073,789	121,186	11,558,325
Pineapples, Canned ...	57,960	7,859,048	59,457	7,083,450
Tapioca ...	31,195	2,988,419	28,257	2,163,170
Arecanuts ...	23,254	5,149,019	19,266	2,804,221
Oil Palm Products ...	3,696	973,787	5,300	1,121,703
Sago ...	2,013	1,040,633	5,133	801,730
Gambier ...	2,697	526,787	2,563	630,914
Hides and Skins ...	1,354	874,980	960	466,304
TOTAL ...	244,134	37,486,462	242,122	26,629,817

It is seen therefore, that the difficulties of the rubber industry are very similar to those of other agricultural industries of Malaya.

Whereas Malaya has maintained the volume of its agricultural export crops during 1931, the prices realised have declined by nearly one-third.

This drop in values has resulted in a smaller purchasing power of the inhabitants. The following figures of the decline in net imports of the principal foodstuffs illustrate this point:—meat, groundnuts, kachang oil, vegetables and sugar have each 10 per cent. decline in quantity; rice 13 per cent; milk, poultry, eggs, fruit, tea each 20 per cent.; livestock for food and coffee 23 per cent. This reduction in consumption is, of course, due in part to the closing down of many estates and tin mines and reduction of labour force on those at present operated, and the consequent repatriation of a large number of labourers to India and China.

The values of the net imports of foodstuffs have shown a decided drop in 1931 as compared with the previous year. As is shown in Table 2, these reductions exceed 40 per cent. for rice, meat, livestock, tea, coffee, groundnuts and kachang oil. For poultry, eggs, vegetables and fruits the reductions in values are between 30 to 40 per cent., while milk has dropped 21 per cent. and butter 16 per cent. The two latter products however, do not effect a large proportion of the community.

TABLE II.

Net Quantity and Value of Principal Foodstuffs Imported into Malaya in 1930 and 1931.

PRODUCT.	How Stated.	1930		1931	
		Quantity.	Value $	Quantity.	Value $
Rice and Padi ...	Tons	594,322	64,464,222	518,230	35,176,019
Livestock and Meat ...	Tons	—	10,320,833	—	6,054,613
Milk, butter, poultry, eggs ...	Tons	—	15,103,734	—	11,486,447
Vegetables ...	Tons	52,773	6,091,512	47,553	4,126,187
Fruits ...	Tons	19,948	3,757,745	16,053	2,510,520
Sugar ...	Tons	101,881	8,310,408	91,855	6,584,800
Groundnuts and kachang oil ...	Tons	21,131	5,020,786	20,098	3,650,423
Tea ...	Lbs.	8,732,453	2,872,220	6,848,642	1,667,931
Coffee ...	Lbs.	8,992,695	1,819,713	6,959,608	972,578
TOTAL ...		—	$117,761,173	—	$72,229,518

The net imports of the necessities of agriculture in Malaya, such as feeding stuffs for animals, fertilizers, rubber cases, agricultural implements and machinery all shew considerable reductions in quantity and an average decrease in value of over 40 per cent.

The luxury tobacco, the imports of which were well maintained during 1929 and 1930, exhibited a rapid fall in quantity (28 per cent.) and in value (39 per cent.) in 1931, in comparison with the year 1930.

A number of other agricultural (or closely allied) products are imported into Malaya, including charcoal and firewood, (the net imports of which were valued at just over a million dollars in 1931, a decrease of 27 per cent. as compared with the value of the imports in 1930) attaps, castor oil, kapok, patchouli leaves, coir cordage and fibre, mats and matting and flowers. These net imports were valued at $1,630,000 a decrease of about $300,000 from the corresponding imports of 1930.

From the above brief review of the exports of agricultural products and imports of foodstuffs it is concluded that the resulting greatly decreased purchasing power of the population has been met partly by a decrease in the cost to this country of necessary foodstuffs. Incidentally, the situation has been eased in some measure by good padi crops reaped in almost all padi-growing districts of Malaya, and by an increase in the production of locally grown foodstuffs. It is evident too, from the fact that the volume of exports has been maintained while the labour force for their production has been reduced by repatriation, that there has been stricter economy of labour. In view of the greater purchasing power of his money, the labourer in regular employment, although on a lower rate of pay, has been able to maintain himself and his family on a scale not very different from that obtaining before the present economic depression.

THE PREPARATION AND DISPOSAL OF PINEAPPLE BRAN.

Forwarded to the Department of Overseas Trade by the British Consul at Honolulu. September 1931.

General.

Pineapple bran is the name now given to the by-product of the pineapple canning industry and has entirely replaced the earlier name of "dried pineapple waste" which connoted a residue of considerably less commercial prestige than the article itself enjoys. Its production on a commercial scale is of comparatively recent date and its use was at first practically limited to that of a ferilizer, but it was discovered by experience that this application of the product was not only uneconomical on account of the necessity of transporting it to the pineapple fields but was unsatisfactory on account of paucity of nitrogen and was in addition injurious to the soil owing to the high percentage of acid content. Furthermore its tendency to attract flies, beetles and various insects rendered it unsuitable as manure, and its use for this purpose has been almost entirely abandoned.

The demand which it enjoys as a stock feed continues, however, to grow, though as yet it has not been found possible to dispose of the entire production of the canning companies. The total amount of bran produced has risen from 1,726 tons in 1923, when production was first seriously undertaken on a commercial scale, to 10,916 tons in 1930, but it does not appear likely that there will be any appreciable change in the present season (1931). The increase in the pack from twelve to thirteen or fourteen million cases would suggest a corresponding, or even proportionately larger, increase in the amount of the by-products, particularly as a potential pack of sixteen million cases is being restricted, on account of over-production, by the rejection of all but first grade fruit, which implies that a larger proportion of the fruit which enters the canning factory must emerge in the form of bran. The fact, however, is that over-production applies also, though to a smaller extent, to the bran, of which some stocks remain over from last season, and it has therefore been found necessary to dump considerable quantities of the waste products of the canning process on unoccupied lands some miles outside Honolulu.

While the name bran can be considered an appropriate one as representing the dried shell or hull of the pineapple, the final product as used to-day is coarser in texture than ordinary brans or meals. In itself it is of low protein content and must be mixed with other materials such as corn, soya bean, wheat-bran, coconut meal, linseed-oil meal, etc. in order to make it suitable as a feed for livestock, and in this form it has achieved a market success.

The method, commonly employed, of mixing the bran with cane molasses, of which there is an abundant supply in these islands, is referred to on page 7 of a pamphlet entitled "Pineapple bran as a feed for Livestock", but one of the canning companies now produces a "molasses-bran" by mixing the molasses with the bran prior to the drying process, as described below. The major part of

this product is shipped to the continental United States, thus obviating the necessity of transporting the molasses separately, while the plain bran is consumed almost entirely in Hawaii. The advisability of using molasses at all with pineapple bran is apparently doubted in some export quarters for the reason that the bran itself is sufficiently rich in sugar, and the molasses contribute none of the proteins which it lacks and which must be applied to make it suitable as a stock feed.

The molasses bran retain to a slight degree the dark colour imparted to it by the molasses before the drying process.

Method of Preparation and Machinery Used.

The material used in the preparation of pineapple bran consists of waste skins, ends, cores, peelings and rejected slices accumulated in the canning process.

All of these unused portions run on conveyers into a *juice bath* which prevents any heavy foreign matter, such as for instance a small part of a machine which has accidentally become detached, from reaching the delicate shredders and presses at a later stage of the process. The lighter matter floats in the bath and is caught up by a series of inverted rakes fixed to an endless belt by which it is conveyed to a higher level and into the *mill* or *shredder*. This is a vertical machine, similar to that used in the crushing of beet and copra, and consists of a worm revolving about a vertical axis, the motive power being supplied by an individual motor fixed to the top of the mill. The juice which results from this and subsequent pressings is carefully collected and used in the preparation of by-products like citric acid and calcium citrate, whereas the juices which emerge in the initial stage of the process from the "Ginaca" or shelling and coring machine are clarified by centrifugal action, which rids them of fibrous matter, and utilised in the canning of the fruit, or are sold separately.

From the vertical mill the waste passes into a *press* which comprises two sections, *viz.* the first chamber in which are two toothed rollers in juxtaposition and geared so as to revolve at different rates about a horizontal axis the power being furnished by external dynamos, and the second chamber consisting of a worm and screen.

The resulting pulp is passed through the shredders and pressed a second, and in some cases even a third, time and is then conveyed to the *dryer*, which consists of a large cylindrical drum, revolved at the rate of about four revolutions a minute by external contact. In the earlier days of the preparation of pineapple bran one of the canning companies, which at the present time account for some 35 per cent. of the total pack, used a drying drum measuring 40 feet by 5 feet diameter, but their present drying equipment consists of two drums of 40 feet length and 8 feet diameter. The larger diameter facilitates internal repairs to the blades fixed to the inside walls of the cylinder at varying angles, so as to ensure the thorough mixing of the bran as the drum revolves. At the entrance end of the drum is a large oil burning furnace which supplies the combustion gases by which the bran is dried to a moisture content of about 9 per cent. When the bran has been

made sufficiently light it is automatically wafted by the combustion gases through the aperture at the end of the drum and is collected. Capacity varies with the amount of moisture present in the bran when it enters the drum. Approximately 10,000 lbs. of water are evaporated per hour.

The only modification in the process of preparing "molasses bran" is that a stream of molasses is allowed to fall on the pulp as it is being conveyed from the final pressing to the dryer.

Machinery: Manufacturers and Cost.

The machinery used in the process by the three large canning companies in Honolulu was designed for the particular requirements of each factory by Mr. Henry Schwartz of the Schwartz Engineering Company, 208, Mach Building, Denver, Colorado, U.S.A. The greater part of the machinery was manufactured by that company and the remainder under its supervision. The designs of the drying furnaces, for example, were prepared by Mr. Schwartz, though the furnaces themselves were made locally to the required specifications. The drums, however, were manufactured by the Schwartz Company.

The matter of the cost of the machinery is a difficult one, since price is entirely dependent on the requirements, and this naturally varies with the output per hour, the power available, housing accommodation etc. It is suggested that specifications and estimates should be procured from the Schwartz Company to suit individual requirements, since these are likely to differ very materially from those of the pineapple canning industry of this Territory, which accounts for about 95 per cent. of the world's production.

The preceding rough outline of the preparation of pineapple bran will perhaps have failed to convey a correct impression of the extensive character of the machinery used and of the space required to house it. In the canning factory of the Hawaiian Pineapple Company, which in 1930 packed nearly 105 million cans and produced something like nine million pounds of bran, the shredders and presses are in triplicate, and the drying drums and furnaces in duplicate. The shredders and presses are situated at a considerable altitude, while the drums are at ground level, so that a large amount of the available space in the factory is taken up by conveyors, shoots etc. and by the electrical machinery which supplies the power for the crushers and presses.

Some idea of the cost of the machinery in use in the model cannery of a highly developed concern like the Hawaiian Pineapple Company may be formed from the following figures :—

Vertical Mill	...	3,500 — 4,00	U.S. dollars.
Worm and screen press	...	10,000	do.
Motor and Drive for press	...	3,000 — 4,000	do.
Drying drum	...	40,000 — 50,000	do.

The Economics of the Preparation and Marketing of the Bran.

One important consideration in connection with the preparation of pineapple bran is that until recent years the disposal of the waste products of the canning industry involved the companies in considerable expense, since the refuse had to be burned, dumped into the sea or put back on the fields as fertilizer. Where, as in the case of Honolulu, the canneries are within the city limits, the cost of transportation—even for dumping—are heavy, and the initiation of a process for utilizing the refuse in the preparation of a saleable commodity has justified the outlay of elaborate and expensive machinery necessary to that end. It is estimated that only approximately 50 per cent. of the pineapple is suitable for canning, the remaining 50 per cent. consisting of the shell, core, trimmings and ends; and at time like the present, when production is being restricted by careful selection, the percentage of waste in one pineapple is much higher then 50 per cent.

The bran is packed in eight ounce jute bags of 100 pounds each and, as already explained, is absorbed almost entirely by the local market. The present selling price is $17.00 per ton, f.o.b. factory, Honolulu, but it has in recent years fetched as high a price as $24.00 per ton. One of the canning companies has recently contracted to supply as much as 75 tons per month to the Honolulu Dairymen's Association as a stock feed. Another company which in 1930 produced 100,000 bags of 100 lbs. each (say 4,500 tons) has already sold its 1931 output, which however is not expected to reach more than fifty or sixty thousand bags, large quantities of the waste having been thrown away during the season on account of excess production.

It was stated above that in 1930 the Hawaiian Pineapple Company produced 105 million cans of pineapple and in the same period the production of bran amounted to roughly 100,000 bags or 10,000,000 lbs.; so that, in the probably justifiable assumption that there was no effort to restrict production in that year, it follows that 1 lb. of bran results from the filling of 10 cans, or (very approximately of course) that about 10 pineapples produce, as a by-product, one pound of bran. In the present (1931) season enforced restrictions demand that only approximately half that amount of bran will be produced by the same number of the fruit.

Review.

Hydnocarpus Oils in Malaya.

By C. D. V. Georgi, O.B.E., B.Sc., F.I.C., T. A. Buckley, M.Sc., Ph.D., A.I.C., and Gunn Lay Teik, B.A., Department of Agriculture, S.S. and F.M.S.
Special Bulletin, Scientific Series No. 9. 18 pp. 1932.
Price 50 cents (Straits).

Since chaulmoogra and hydnocarpic oils, obtained from the seeds of *Taraktogenos* and *Hydnocarpus* have been applied to the treatment of leprosy, the cultivation of one species of *Taraktogenos, T. Kurzii* and two species of *Hydnocarpus, H. anthelmintica,* Pierre and *H. Wightiana,* Blume has been undertaken at the Government Experimental Plantation, Serdang, the two latter having now reached the bearing stage.

In the publication just issued, the authors record their results of the examination of samples of the seed from the point of view both of comparing the oil contents and of ascertaining the quality of the oil that can be obtained by treating the seeds on a commercial scale. The constants of the two oils were also determined and a partial examination made of the individual fatty acids present as glycerides in the oils.

The authors conclude that provided the fruits are harvested soon after they fall and the seeds are cleaned and dried without delay, the preparation of high quality oil on a commercial scale would present no difficulties. It is shewn that the oil content of the seeds of *H. Wightiana* is double that from *H. anthelmintica.* As a source of pure hydnocarpic acid, the oil from the former variety would be preferable, since after fractional distillation of the mixed ethyl esters the contaminating esters—that is, those other than hydnocarpic and chaulmoogric—are found associated with the latter ester, leaving the hydnocarpic ester in a relatively high state of purity. This is not the case, however, with the oil from *H. anthel-*
,, tica.

From the point of view of yield and purity of oil, it would be preferable to plant *H. Wightiana,* provided that its cultivation is equally satisfactory.

These conclusions are of definite value in view of the increasing importance of these oils in medicine, which should result in a certain demand for a reliable source of supply.

D. H. G.

Miscellaneous Article.

ENTOMOLOGICAL NOTES.

First Quarter, 1932

BY

G. H. Corbett.

During the past two years the writer has endeavoured to incorporate in these quarterly notes interesting as well as important observations on insects which have been observed during the preceding three months. In publishing these notes there is the danger of placing before the public statements which may prove on further association with a problem to require modification. Entomological problems in Malaya as elsewhere are many and not the least is the agents responsible for causing and for terminating outbreaks of insects. Several insects can be named which are reported during the first few months of each year as inflicting severe and extensive damage to plants, and, in some cases, these reports are received from the same areas although the identical plant is generally cultivated throughout Malaya. Why for instance does *Setora nitens* Wlk.—a nettle caterpillar of coconuts—appear in enormous numbers about the same time every year, in one particular area of Malaya?. Why are *Amathusia phidippus* L. and *Hidari irava* Moore., both insects of coconuts, found each year in another area in considerable numbers? Why has *Psilopholis grandis* Cast. not been reported in Malaya causing damage to the roots of mature rubber trees in areas other than in an area of about 80 acres? The wide term climate undoubtedly in some ways plays its part. Unfortunately detailed observations are not available as to the time insects begin to increase. It is only when they are seen in enormous numbers that they are reported.

Regular weekly consignments of a few insects have been received during the past quarter and in the case of *Amathusia phidippus* L., Chalcid and Tachinid parasites from the pupae would undoubtedly appear to be responsible for the disappearance of this butterfly. Several well-known pests of gutta percha occur in Malaya and the caterpillars of *Stauropus lichenina* Butl. are particular prevalent during the early months of the year. At the time of writing the caterpillars of this Notodontid moth cannot be found but the consignment of eggs received in the first week of March was completely parasitised, indicating that egg parasites may be responsible for the disappearance of this pest.

The above two-named insects having been apparently subdued by parasites, the problem still remains what agents bring about their increase?.

Oil Palms.

It is considered that the Rhinoceros beetle (*Oryctes rhinoceros* L.) prefers coconut to oil palms but this insect may become an important pest of oil palms if conditions are favourable. It is not, apparently, generally known that this beetle lays its eggs in decaying vegetable débris of almost every description.

Here the eggs hatch, the grubs feed and pupate and finally emerge as the familiar Rhinoceros beetle which bores into and feeds upon the young unfolding leaves.

During this quarter the writer was asked to visit an estate in order to discover the breeding places of this beetle. They were found in palm refuse around the factory, in heaps of palm fibre waste which had been deposited along the truck tracks and at places where the remains of bunches from which the fruit had been collected had accumulated.

Accumulations of this description should be scattered or disposed of in some suitable matter.

Rubber.

In "Entomological notes for the Fourth Quarter, 1931" reference was made to grubs damaging the roots of mature rubber. The beetle in question has recently been identified as *Psilopholis grandis* Cast. The two Scoliid parasites, not three, are *Campsomeris javana* Lep. and *Campsomeris pulchrivestita* Cam. Both these parasites are numerous although large grubs of *Psilopholis* are now comparatively rare.

Both these parasites first lay hold of a mandible and sting a grub in the ventral thoracic region near the first and second segments. After stinging the grub effectively, they drag it to a suitable place with the ventral surface uppermost. The mandibles and the last abdominal segment play important parts in kneading the grub into proper shape. This operation having been completed, the ventral surface and spiracles are painted with what appears to be the sting. This painting process has occupied six minutes. Finally, walking forward with the head in juxta-position with the head of the grub, an egg is dropped which remains in an erect position.

The majority of eggs of both *C. javana* Lep. and *C. pulchrivestita* Cam. are dropped mid-ventrally on the fourth abdominal segment. With both these species, the egg stage is about 3 days, the larval stage about 6—7 days and the cocoon stage 27—32 days.

Coconuts.

An unusual outbreak of the gelatine caterpillar of the Limacodid moth, *Chalcoscelis fumifera* Swinh., was reported in February over an area of some 100 acres of coconuts. Occasionally caterpillars of this moth have been collected but this is the first record of its occurrence in considerable numbers in Malaya.

The eggs are very difficult to see, the full-grown caterpillars are about 20—25 mm. in length, pale blue with whitish coloured markings and resemble convex lumps of jelly. The cocoon is round and whitish in colour.

The study of the insects of copra has been continued. Various attractants for the control of *Necrobia rufipes* de Geer. (the copra bug) have been tried. It would appear that valerianic attracts this beetle in greater numbers than oleic acid and that the mixed fatty acids from coconut and palm oils are more attractives than oleic. Copra in several forms has been tried and preliminary results indicate that wet mouldy copra is more attractive than well-prepared and other forms of copra.

Departmental.

FROM THE DISTRICTS.

The Weather.

In Kedah, Western Pahang and Malacca, the prolonged spell of dry weather terminated towards the end or in the middle of the month. The rain storms which followed caused somewhat severe flooding in Pahang. In Kelantan the first three weeks were cool and showery with strong winds, the last week, however, being hot and dry. Elsewhere the first half of the month was dry, but fairly heavy rain fell almost daily in the second half.

Remarks on Crops.

Rubber:—Termination of the negotiations between the Dutch and British representatives in the definite announcement that no scheme of rubber restriction would be introduced caused a further fall in the price of the commodity and put an end to speculation by local dealers. Prices of small-holders' rubber ranged in dollars per picul from 4 to 9.80 for smoked sheet, 3 to 9.60 for unsmoked sheet, 1.50—6 for scrap and 1.50—5 for lump and slab. In Selangor very little scrap rubber could be sold.

Wintering had practically finished at the end of the month and the new flush of foliage was developing well.

Owing to the decrease in yield due to wintering and the further fall in price, many owners and tappers of small rubber holdings left their holdings and took work as harvesters in the neighbouring padi fields wherever reaping was still in progress. In Penang Island and the Dindings they supported themselves by taking any work available. In practically all States only those holdings were tapped of which the owners had no other means of subsistence. During the wintering period the trees were also rested on a certain number of estates.

It appears that small-holders are now beginning to realise that no rise in the price of rubber can be expected in the near future, since they are paying more attention to their formerly neglected mixed orchards or coconut holdings and are also planting up more vegetables and food crops. As yet, however, few have the courage to cut out their rubber to make room for other crops.

The dry season combined with cessation of tapping on many holdings has checked the incidence of mouldy rot disease. With the return of wetter conditions, however, extensive outbreaks must be expected, since the poverty of many small-holders forbids the excution of adequate control measures, the purchase of even the cheapest disinfectants being now beyond their means.

Leaf mildew (*Oidium Heveae*) appeared in two localities in Province Wellesley, on seven estates in Negri Sembilan, on one estate as well as on certain small holdings in Malacca, and in the District of Muar, Batu Pahat and Segamat in Johore. The attacks were in most cases slight.

Padi:—At the end of the month the padi harvest was completed except in certain late-planted areas in parts of Kedah, the Central and Southern Districts of Province Wellesley, a few localities in Perak, parts of Kuala Selangor District and Kuala Pilah District of Negri Sembilan. Yield records available confirm the anticipation of a good crop in Kedah, Province Wellesley North and Malacca, and of satisfactory crops elsewhere. The crop in Krian is roughly estimated at about 18,000,000 gantangs, allowance being made for the fact that crops in past years have probably been under-estimated. In Kuala Pilah District yields of pure strain varieties of padi from 1/40th. acre plots have varied from 360 to 760 gantangs per acre, with an average of 480 gantangs per acre, while the corresponding figures for local mixed padi have been 200 to 400 with an average of 340 gantangs per acre. At Ulu Sat in Kelantan, Seraup Kechil No. 36 gave 688 gantangs per acre as compared with 410 gantangs from the local padi Trong. In Baroh Merkang Nachin 27 gave 725 gantangs per acre.

In Krian prices for padi at the roadside have been between 7 and 8 cents per gantang. Prices in Kedah and Province Wellesley ranged between 7 and 10 cents and in Malacca between 6 and 9 cents; elsewhere prices were variable between 8 and 16 cents per gantang.

In the parts of Selangor where an inter-season crop is being planted, some 1,900 gantangs of seed were distributed and nurseries were sown. Nurseries were also laid down in Temerloh District wherever water was available. The repairing of dams and clearing of water-ways was commenced in parts of Negri Sembilan.

Coconuts:—The Kuala Selangor scheme for improving the quality of copra made on small holdings and encouraging the Malay owners to manufacture their own copra in making steady progress. Similar schemes have been started in Kuala Langat and in Sabak Bernam Districts, where a few cheap kilns of an improved type have been erected. The copra manufactured on these kilns is much better than the average product from small holdings and obtains a better price.

While good yields are reported from parts of Province Wellesley, yields in the coastal districts of Selangor are still much below the average. The harvesting of immature nuts for the Malay New Year in February caused a shortage of crop in March in Negri Sembilan, with a rise in the price of nuts in Port Dickson District. A scarcity of coconuts is also reported in Raub District of Pahang, where prices have risen to 6 or 7 cents each.

Tobacco:—While the area planted with tobacco is extending in most parts of the country, it is becoming considerably reduced in Province Wellesley, owing in part to low prices, adverse weather conditions and the incidence of the stem borer pest, and in part to the local transport permits required by the excise authorities to prevent smuggling under cover of local production.

Tea:—The bushes on the Chinese small holdings in Ulu Langat District showed good growth and gave a good flush of leaves after the February rains.

The price of the product, however, at 40 cents a kati for the first quality, was too low to encourge further planting.

Fruit :—In several parts of the country local fruit trees were flowering freely and giving promise of good crops later in the year. Interest in fruit cultivation is reviving and steps are being taken to enable the Agricultural Stations to meet a demand for planting material at prices within the means of small-holders.

Rat Control in Padi Fields.

In Krian District control in the proximity of houses and in breeding grounds has been continued. Specimens of rats sent to Raffles Museum were found to comprise only two varieties, the common Malayan field and house rats. In Province Wellesley and Penang, control by means of poisoned baits and traps continued. During the present breeding season, however, because rewards are no longer paid for tails in the Province, Malay padi growers and local Tamil labourers have been unwilling to undertake the work of digging nests out of the bunds of the padi fields and destroying the young, as they have done regularly in past years. In consequence, young rats were in evidence in several localities and nests full of them were found to be numerous in several bunds examined. In Malacca, where a reward of one cent for four tails is still paid, 103,814 tails were collected mainly from nests in the padi fields.

Agricultural Stations and Padi Test Plots.

Kedah—*Telok Chengai Rice Experimental Station* :—Harvesting was completed under good weather conditions. Records of selected strains and manurial experiments were worked out and forwarded to the Department of Agriculture, S.S. & F.M.S., for statistical examination. The straw on all the plots was evenly scattered over the land to decay.

Gajah Mati Agricultural Station :—A temporary house for the officer in charge of the Station was erected and preparation was made for building nursery sheds.

Penang and Province Wellesley—*Glugor Padi Test Station* :—The harvest was completed at the end of the month. Results were disappointing, since the earlier planted varieties were so severely damaged by rats as to give no reliable yield records. The later-planted varieties did not suffer so seriously and gave average yields. Seedlings for the inter-season crop received their first transplanting and looked healthy. Plots were being prepared to receive them.

Bukit Merah Padi Test Station :—Reaping was completed early in the month. The crop was dried and weighed and a report of the yields from the different trials and experiments was submitted to Headquarters for statistical examination. Yields were good and the records are expected to give useful information.

Bukit Mertajam Agricultural Station :—Contracts were about to be let for felling and clearing and also for fencing this site.

PERAK—(*a*) *Agricultural Stations—Selama* :—An adequate rainfall during the month assisted the growth of the recently-planted crops which survived the January drought. It also provided suitable conditions for planting shade trees of *Albizzia molucanna* and a cover crop of *Indigofera endecaphylla* in the tea area, together with plots of cinnamon, brinjal, rambutan, Avocado pear, orange, groundnuts and pineapples.

Kuala Kangsar :—Further terracing work was carried out and holes were dug and prepared for planting a few budded stumps of certain selected clones of rubber. Crops planted included gingelly, cinnamon seedlings and pepper cuttings in the nursery. Harvesting the leaves from a good crop of Rangoon tobacco was commenced. Mortality has been high among young tea planted during dry weather in January, in spite of daily watering. A good crop of maize was maturing and the plot of groundnuts showed good growth. *Calapogonium mucunoides* was sown as a cover crop on plots in fallow.

(*b*) *Padi Stations and Test Plots, Tatang* :—Harvest was completed and records of the different plots entered up for analysis. The yields obtained appeared to be good, in spite of the fact that the padi was completely submerged in the December flood.

Bruas :—Harvest was completed and yield records were being prepared.

Bukit Gantang :—Harvesting was completed on March 20th. Detailed results have not yet been calculated but yields appear to range from 161 to 590 gantangs per acre on the different plots.

Kamunting Silmed Area :—Harvesting was commenced and completed during the month. This isolated plot of padi suffered so severely from the ravages of birds, in spite of all precautions, that the yield records are of no value for comparative purposes. The yields actually ranged from 125 to 214 gantangs per acre, but it is estimated that, had damage by birds been normal, they would have been in the vicinity of 250 to 300 gantang per acre.

Selinsing Manurial Trials :—The records of results obtained have been calculated and forwarded to Headquarters for analysis.

SELANGOR—*Cheras Agricultural Station* :—Crops planted were several varieties of yams and sweet potatoes, plots of ginger and arrowroot, and cinnamon seedlings. Two varieties of tuba were transplanted into the field, while the planting of certain hedges, grass borders to the paths and other improvements to the appearance of the Station received attention.

Kajang Padi Test Plot :—The work of clearing this Plot for the inter-season crop was commenced and nurseries of four additional pure strains of padi were planted.

Kuang Padi Test Plot :—The work of clearing this area for the inter-season crop was commenced and nurseries of five additional pure strains, making six in all, were established. The recently planted nurseries of Nachin 27 were found to be attacked by stem borers early in the month and were treated with tuba root solution which checked the pest.

Negri Sembilan—*Seremban Fruit Nursery*:—Suckers of the banana, Pisang Serendah, which had proved immune to Panama Disease at Jelebu, were planted. A root crop, known as Ubi Kling, was harvested and gave a good yield. This and other plants from the Nursery were distributed to school gardens and individual growers.

Rembau Agricultural Station:—Crops planted were cloves, varieties of yams, bananas, soya bean and tuba, with Ubi Kling and cinnamon.

Rembau Padi Test Plot:—Harvesting was continued, but birds took much of the crop.

Pahang—*Kuala Lipis Agricultural Station*:—Hot weather early in the month and floods later checked the recently planted tobacco and the banana supplies. Soya bean, local maize and groundnuts were sown and cinnamon seedlings were planted in the nursery.

Temerloh Padi Test Station:—Nurseries of three more pure strains, making six including the control, were planted.

Malacca—*Pulau Gadong Padi Test Station*:—The report of the season's results was completed and submitted to Headquarters for statistical examination.

Sungei Udang Agricultural Station:—Terracing in the coffee area was finished. The bund round the padi area was completed and the irrigation channel was re-graded and improved. The buildings were completed and taken over from the Public Works Department.

Singapore—*Pineapple Experiment Station*:—Applications of manure in accordance with a revised scheme have been given to the manurial and other experimental plots. A few pulasan and rambutan marcots were planted and a small supply of seeds for raising seedlings was obtained. Eight different types of tobacco are under cultivation in small plots. The plots for manurial experiments with Hickory Prior variety of Virginian tobacco were planted up, but owing to a shortage of seedlings the scheme had to be modified to include only 41 plots.

School Gardens.

During the month, many of these gardens were re-opened after the holidays. Attention was given to improving the layout, cultivation, manuring and replanting of beds. Fences were repaired in some cases. Planting material was supplied to a number of gardens. During visits, notes were made of schools where the supply of tools was inadequate, where supplies of the seeds of common vegetables were deficient and of various matters that required attention. In Johore sites have been selected for sixteen schools gardens, to fifteen of which tools have been supplied and printed instructions on the layout and care of gardens. In these fifteen gardens the layout of beds and paths has been pegged out and their preparation is in progress; the work of felling and removing trees and stumps, where necessary, has been commenced on contract. Considerable enthusiasm is being displayed in the establishment of these new gardens.

DEPARTMENTAL NOTES.

Exhibition for Tourist Ships.

In compliance with a request from a local shipping agent, the Department of Agriculture staged an exhibit at Malacca of the products of Malayan agriculture for the benefit of the passengers of two American tourist ships which called at that port on 2nd and 3rd March, 1932.

The crops staged included rubber, coffee, tea, canned pineapples, kapok, tuba, Hydnocarpus, arecanuts, padi and rice, tapioca, coconuts, palm oil and palm kernels. The exhibits shewed the various stages—from the crop as harvested to the finished product—of each crop. Suitable photographs illustrated the field conditions under which the crops are grown and explanatory labels were intended to render the display easily intelligible to the visitors.

Most of the tourists were connected in some way with educational activities and the large majority were very much interested in this small exhibition.

Such displays as this should achieve a very useful purpose in advertising Malaya and should draw attention to the very important agricultural products of this country.

School of Agriculture, Malaya.

The Hon'ble Chief Secretary to Government and Mrs. Caldecott paid an informal visit to the School on 3rd March.

A meeting of the Advisory Committee of the School was held at the School on March 1st.

Lectures for the current school year were concluded by March 31st, in view of the approaching final and annual examinations of the students.

Vernacular Publications.

The last number of the quarterly journal of the Department (*Warta Perusaha'an Tanah*) was published on March 10th and completes the ninth annual volume of this publication. The number includes articles on rearing of carp in ponds, co-operation in native holdings, and Liberian coffee.

Volume IV, No. 1 of the Chinese Agricultural Journal was published on March 21st, and includes articles on the cultivation of cloves, fodder and grazing grasses, transport of carp fry from China and the preparation of rubber from the point of view of small-holders.

The Malayan Agricultural Journal for May 1932.

The next number of this Journal will deal with various aspects of the Malayan rubber planting industry in the year 1931. Special articles for this number have been written by the senior staff of the Rubber Research Institute of Malaya and the Department of Agriculture. These original articles will

include the following subjects—budgrafting, manuring, diseases, factory practice and preparation, a review of the industry in Malaya and the conditions obtaining in small-holdings. The close liaison with the Department of Statistics enables the inclusion of the most recent statistics concerning Malayan rubber areas and production in 1931.

Leave.

Mr. F. Birkinshaw, Senior Agricultural Officer, Perak North, has been granted 9 months and 12 days leave on full pay with effect from 6th February, 1932.

Mr. H. Ritchings, Horticultural Assistant, has been granted 9 months and 18 days leave on full pay with effect from 3rd March, 1932.

Dr. T. A. Buckley, Assistant Chemist, has been granted 8 months and 6 days leave on full pay with effect from 11th March, 1932.

Statistical.

MARKET PRICES

March, 1932.

The better values ruling for sterling have, generally speaking, resulted in lower commodity prices. Markets have shown a declining tendency, demand from America and the Continent being particularly weak. The Easter holidays also was a contributory cause of the easy markets.

Rubber.—The official pronouncement against the introduction of a scheme of compulsory restriction has reacted unfavourably on the rubber market, the price having touched a new low record price of 5¼ cents per lb. Singapore, 1 15/16d London and 3 1/16 cents gold New York. Average prices per lb. for the month were as follows:—Singapore, 6.39 cents, London, 2.16d, New York 3.3 cents gold, as compared with 8.18 cents, 2.71d, and 3.95 cents gold respectively for February.

Palm Oil.—The following cabled quotations are c.i.f. Liverpool, f.f.a. basis of 18 per cent. March 2nd £21; 9th £20.15; 18th £19.10; 23rd and 31st £19. The market opened the month steady and ended idle.

The average price for the year 1931 quoted locally for palm oil c.i.f. Liverpool, basis 18 per cent. f.f.a. was £18.8.3, while the average quotations for palm kernels (basis 49 per cent. oil) was £9.19.2.

Copra.—The Singapore market shewed a steady decline throughout the month for both sundried and mixed. The highest price of sundried was $6.50 and the lowest $5.75 per picul, the average price for the month of this grade being $6.17 as compared with $5.67 in February. Mixed averaged $5.67 in March as compared with $5.33 in the previous month.

Copra cake was quoted at $2.20 throughout the month.

Gambier.—The average price of Block gambier was $11.80 per picul and of Cube No. 1 $18.90 as compared with $13.12 and $20 respectively in February.

Rice.—The following are the average wholesale prices of rice per picul in Singapore during February. Siam No. 1 Ordinary $4.62; Rangoon No. 1 $4.17; Saigon No. 1 $4.37 as compared with $4.46, $3.92 and $4.26 respectively in January.

The average retail market prices in cents per gantang of No. 2 Siam rice were as follows:—Singapore 32, Penang 38, Malacca 26.

Arecanuts.—During March, Palambangs averaged $3.49 per picul as compared with $3.62 per picul in the previous month, and Bila Whole $3.59 as compared with $3.76 per picul in February. For other grades the average prices per picul in March were:—Split, $4.58 to $5.83; Red Whole $6.50 to $6.90; Sliced $9.15 to $12.50; Kelantan $5.53, the prices within each range depending upon quality.

Coffee.—Prices have declined somewhat from those ruling at the end of January. Java Robusta dropped from $22 per picul to $20.25, the average price for March being $20.95—$22.50 per picul, the price within this range depending

upon quality. Palambang declined from $18 to $15.75, the average price being $16.83 as compared with $15.69 per picul in February.

Pineapples.—Harvesting of the "big crop" has now begun, but the Home buyers are indifferent and on a stagnant market the prospects of a prosperous season for canners are not at the moment bright. Prices shewed a declining tendency throughout the month. Average Singapore prices per case in March were :—1½ lb. cubes, $3.63; 1½ lb. sliced flat, $3.41; 1½ lb. sliced tall $3.73 as compared with $3.89, $3.57 and $3.80 respectively in February.

Tapioca.—Singapore average prices per picul for March were as follows :—Flake fair, $3.12; Pearl, seed, $4.48; Pearl medium, $4.70. Corresponding prices in February were—$3.14, $4.44, $4.46.

Sago.—Demand has been steady from Eastern buyers, but Home consumers shew no anxiety to fill forward requirements. Pearl small fair averaged $4.45 per picul as compared with $4.37½ in February. Flour, Sarawak fair, averaged $2.38 as compared with $2.70 in February.

Nutmegs and Mace.—Little enquiry, prices shewing a downward tendency. Singapore average prices for nutmegs in March were 110 per lb., $26.90; 80 per lb., $30.70 as compared with $28.80 and $31.75 respectively in February. Siouw mace averaged $59.40 per picul and Amboina $44 per picul as compared with $59.75 and $46.75 respectively in February.

Pepper.—The market steadily declined, buyers in Europe adopting a hand-to-mouth policy and demand from Eastern consumers being small. London stocks showed a further increase. Average Singapore prices per picul in March were :—Singapore black, $22.30; Singapore white, $27.90; Muntok white, $28.35. Corresponding prices in February were $23.87½, $30.87½, $31.50.

Cloves.—Nominal prices have been quoted throughout the month in Singapore at $45 per picul for Zanzibar and $50 for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur, the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore and a report on the Coconut Oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133⅓ lbs.

The Dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY.

February, 1932.

Malaya.—Gross foreign imports of rice during February amounted to 62,573 tons as compared with 56,782 tons for the same month of 1931, of which 61.7 per cent. were consigned to Singapore, 20.4 per cent. to Penang, 3.4 per cent. to Malacca, 13.4 per cent. to the Federated Malay States and 1.1 per cent. to the Unfederated Malay States.

Of these imports, 52.1 per cent. were from Siam, 45.5 per cent. from Burma, 1.4 per cent. from French Indo-China and 1 per cent. from other countries.

Total foreign exports of rice in February 1932 were 16,346 tons as compared with 13,700 tons in February 1931. Of these exports 80 per cent. went to the Netherlands Indies.

Local padi reports indicate that work for the season 1931—32 is in hand in all areas. Harvesting was completed or finished in Perlis and Kedah, where crops are generally reported as being better than for the previous season.

India.—The total area under rice (season 1931—32) is reported at 84,034,000 acres as compared with 82,706,000 acres in 1930—1931, an increase of 1.6 per cent. and the total yield is estimated at 32,770,000 tons of clean rice as against 32,198,000 tons the previous season, or an increase of 1.8 per cent. A record area has been brought under cultivation and a good crop is expected this year except in Burma.

Total foreign export of milled rice (*Indian Trade Journal* 3.3.1932) during December 1931 were 151,000 tons as compared with 102,000 tons in December 1930, an increase of 49,000 tons or 48 per cent.

Total foreign exports of milled rice during the year 1931 were 2,092,000 tons, a decrease of 487,000 tons or 19 per cent. as compared with 1930, and a decrease of 123,000 tons or 5.6 per cent. as compared with the average of the past six years.

The Final Forecast of the Rice Crop in Burma for the season 1931-32 issued on February 13, 1932, gives the area likely to mature as 11,972,000 acres, being 626,000 acres or 5 per cent. less than the final figures of last year. The exportable surplus is still estimated at 3,649,000 tons of padi equivalent to 2,700,000 tons of rice and rice products.

Total exports of rice and rice products from Burma for January 1932, amounted to 291,541 tons as compared with 257,880 tons for the corresponding period of 1931 or an increase of 13.1 per cent.

According to the *Bangkok Times* of February 26, 1932, the heavy orders for rice for Shanghai and the shortage of the crops in Japan, Korea, Siam and Saigon have created a demand for Burma rice and upwards of 700,000 tons had been sold forward for May delivery at Shanghai at prices ranging from Rs. 275 to Rs. 285. Padi has been held up in the districts where the price of Rs. 150 is being demanded against Rs. 110, Rs. 115 offered with only limited quantities

available, and rice is quoted at Rs. 255 to Rs. 260 for February with business being done at Rs. 275 to Rs. 280 for March and April, with higher prices for May. These prices are the highest reached since the last quarter of 1930.

Siam.—Exports of rice from Bangkok during January, 1932, were 108,883 tons as compared with 128,371 tons in January 1931, a decrease of 15 per cent.

Netherlands Indies.—Java and Madura. The *Korte Berichten* states that at the end of January 1932, the area harvested amounted to 208,250 acres, an increase of 38,500 acres or 23 per cent. as compared with January 1931, the area damaged to 3,563 acres an increase of 984 acres or 38 per cent. as compared with January 1931, and additional plantings awaiting harvest to 5,264,000 acres an increase of 50,750 acres or 1 per cent. as compared with January 1931, a total of 5,475,813 acres as compared with 5,385,579 acres in January 1931, an increase of 1.7 per cent.

The area of wet and dry padi harvested in Java and Madura in 1931 amounted to 8,555,000 acres, while the production of this area totalled 5,004,000 tons of rough rice. The imports of rice in 1931 amounted to 282,000 tons and exports to 10,000 tons.

French Indo-China.—Entries of padi at the port of Cholon from 1.1.32 to 29.2.32 amounted to 189,789 (metric) tons, an increase of 43,329 tons or 30 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period 1.1.32 to 29.2.32 amounted to 188,335 (metric) tons, an increase of 74,893 tons or 66 per cent. as compared with the same period of 1931.

The following is an extract from the *International Crop Report, Rome,* for January 1932:—"Indo-China: Drought has generally hindered transplanting of the second crop but the duration of its effects has varied according to region. In Tonkin, despite the delay in transplantings, the very early rains allowed operations to be completed under good conditions and transplantings of late varieties to be prolonged. The area planted is also greater than normal and a crop at least equal to the average was expected. In Annam conditions have varied greatly; save in the south, the drought has reduced the area transplanted and has been very prejudicial in a number of sectors so that, on the whole, the crop of the second semester appears to be mediocre.

In Cochin-China the rainfall regime has been very variable, deficient in the majority of provinces and excessive in others. Consequently the condition of transplantings and standing crops varied greatly. In Cambodia the rains, more or less abundant according to region, permitted all the fields to be brought under cultivation. The situation was satisfactory. In Laos the drought hindered the transplanting of an important part of the lowland fields in some provinces; other provinces suffered from lack of water. Condition of upland rice was satisfactory."

The padi market (official report) in January 1932 was fairly active. Arrivals of new crop padi were becoming more frequent. Rates remain fairly steady. The considerable quantities bought and sold during the second half of the month

made very little difference to the price. Large quantities of all kinds are now stocked in Cholon.

In the rice market, a certain amount of business was transacted. There were enquiries from aboard for immediate shipment and France continued to buy steadily. Some attempts to do business with Shanghai and Java were reported, and shipments on the former port slowed down considerably owing to the political and financial situation. The Hong Kong market was calm. The market closed on a calm note with a tendency to weaken.

The Brokens market was steady, enquiries being numerous. Certain sellers, considering the prices offered by the exporters as excellent, sold large consignments in advance without any stocks to back them. Stocks are low and the market closed very firm.

Japan.—The area under rice for the 1931 rice crop amounted to 7,959,406 acres, an increase of 23,070 acres or 0.3 per cent. compared with 1930. The production amounted to 7,744,076 tons, a decrease of 1,635,356 tons or 17.4 per cent. as compared with 1930, due to bad weather conditions.

According to the Japanese Government, supply and demand for the year ending 1932, are estimated as follows:—

		Supply Tons.	
Stocks on November 1, 1931	...	1,282,000	
Actual Rice Crop	...	7,744,000	
Korean Imports	...	912,000	
Formosan Imports	...	351,000	10,289,000
		Demand Tons.	
Exports	...	108,000	
Consumption	...	10,184,000	
Retention as Government Stocks	...	701,000	10,993,000
		Deficit ...	704,000

According to the *Bangkok Times* of February 26, 1932, Japan had dropped her embargo against the purchase of foreign rice owing to the shortage of her own crop, as well as that of Korea, Siam and Saigon, was buying where she could, and had placed orders in Burma for the bulk of the shipments to Shanghai.

Korea.—According to the Ministry of Overseas Affairs the production of rice for the year 1931 amounted to 2,226,227 tons, a decrease of 463,910 tons or 17 per cent. as compared with 1930.

Formosa.—The area under rice for the second crop of 1931 was 887,760 acres, an increase of 30,535 acres or 4 per cent. as compared with the corresponding crop of 1930, and production amounted to 540,145 tons a decrease of 5,116 tons or 1 per cent. as compared with the second crop of 1930.

Italy.—In Italy the area and production of rice (1931—32) are estimated at 346,000 acres and 621,340 tons as compared with 361,000 acres and 639,870 tons

in 1930—31, being decreases of 4 per cent. in area and 3 per cent. in production.

America.—In America the area and production of rice (1931—32) is estimated at 970,000 acres and 904,286 tons as compared with 959,000 acres and 889,955 tons (1930—31), increases of 1 per cent. in area and 1.6 per cent. in production.

For the period January 1 to December 18, 1931, a total of 159,223 tons of rice were shipped from the East to the West Indies and America, as compared with 200,644 tons in 1930.

Quantities of rice shipped from the East were :—

(*a*) To Europe, period January 1 to February 11, 1932, 52,000 tons as compared with 35,333 tons for the same period of 1931, or an increase of 47.2 per cent.

Of this 62.5 per cent. was from Burma, nil from Japan, 33.4 per cent. from Saigon, 2.2 per cent. from Siam, and 1.9 per cent. from Bengal as compared with 16.1 per cent. from Burma, 23 per cent. from Japan, 39.8 per cent. from Saigon, 20.6 per cent. from Siam, and .5 per cent. from Bengal in 1931.

(*b*) To the Levant, period January 1 to December 30, 1931, 71,305 tons, an increase of 49,810 tons or 231.7 per cent. as compared with 1930.

According to the *International Institute of Agriculture monthly Crop report* for January 1932, information concerning the probable production of 1931—1932 in the major exporting countries shows the following :—

(*a*). *Burma* : A decrease of 12.8 per cent. in production,

(*b*). *Indo-China* : A decrease in the total production,

(*c*). *Siam* : A decrease of 17 per cent. in production (Seven exporting circles).

The report also states the following : " Now that it is definitely known that there has been a marked decline in the production of Siam, much more pronounced than in that of Burma, while unfavourable weather has further reduced the crop in the latter country and seems likely to have a similar effect in much of the Indo-Chinese area, the situation on the supply side may be said to be somewhat more favourable than it could said to be last month. On the demand side, however, prospects still remain very doubtful."

ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING IN MALAYA, JANUARY, 1932.

(Estates of 100 acres and over.)

AREA	Acreage of Tappable Rubber	Estates which have entirely ceased tapping		Estates which have partly ceased tapping		Total (3) + (5)	Percentage of (7) to (2)
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Federated Malay States ...	789,444	35,544	4.5	90,703	11.5	126,247	16.0
Johore ...	298,778	19,631	6.6	42,667	14.3	62,298	20.9
Kedah (*a*) ...	(*b*) 118,236	11,175	9.4	15,706	13.3	26,881	22.7
Kelantan ...	16,785	6,742	40.2	796	4.7	7,538	44.9
Trengganu (*c*) ...	4,300	nil	nil	nil	nil	nil	nil
Perlis ...	624	308	49.4	156	25.0	464	74.4
Straits Settlements ...	210,642	18,232	8.7	32,287	15.3	50,519	24.0
Malaya ...	1,438,809	91,632	6.4	184,315	12.6	273,947	19.0

Notes:—1. (*a*) Registered companies only and are rendered quarterly, commencing with end June 1931, inclusive.

(*b*) Estimated in the ratio of acreage of tappable rubber to acreage planted end 1930.

(*c*) Registered companies only.

2. Areas rested due to rotational tapping system end January: acres F.M.S. 44,097, Johore 31,679, Kedah 34,713, Kelantan 1,005, Trengganu 1,394, S.S. 15,171, total 128,059 acres or 8.9 per cent. of tappable area (Col. 2).

Singapore, *March 29*, 1932.

J. I. MILLER, M.C.S.
Ag. Registrar-General of Statistics, S.S. and F.M.S.

THE OIL PALM INDUSTRY IN MALAYA, 1931

Area.—A total of 4,193 acres were planted with oil palms during the year, of which all but 877 acres were planted in Johore. The total area under this crop at the end of 1931 was :—Perak 17,165 acres, Selangor 13,092 acres, Negri Sembilan 920 acres, Pahang 788 acres. Total F.M.S. 31,965 acres. In addition there are 24,395 acres in Johore and 600 acres in Kelantan, giving a total area in Malaya of 56,960 acres.

Production.—There are 16 oil palm factories some of which, being newly erected, were in operation for only part of the year.

Actual production, as declared by estates, amounted to 5,135.6 tons of palm oil and 772.9 tons of palm kernels.

Exports.—The exports of palm oil and kernel from Malaya amounted to 4,574 tons palm oil valued at $1,009,610 and 726 tons of kernels valued at $112,093. The figures of exports for 1930 were :—palm oil 3,211 tons valued at $892,995 and kernels 485 tons, valued at $80,792.

Prices.—The average price of palm oil in 1931, quoted locally c.i.f. Liverpool, basis 18 per cent. f.f.a. was £18. 8s. 3d. per ton, while the average of prices received locally for kernels, c.i.f. Liverpool, basis 49 per cent. oil was £9. 19s. 2d. per ton.

MALAYAN AGRICULTURAL EXPORTS, JANUARY 1932.

Product	Net Exports in Tons		
	Year 1931	January 1931	January 1932
Coconuts, fresh ...	10,468	540	6,559 *
Copra ...	100,809	7,579	5,494
Coconut Oil ...	9,909	814	959
Palm Oil ...	4,574	295	392
Palm kernels ...	726	14	45
Pineapples, canned	59,457	5,481	5,623
Tapioca ...	28,257	2,347	1,881
Arecanuts ...	19,266	1,854	3,073
Gambier, all kinds	2,563	185	246
Tuba root ...	74	5	5†

*'000 in number.

† Excess of imports over exports.

MALAYA RUBBER STATISTICS

TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF FEBRUARY, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	during the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	18,352	13,597	11,231	25,169	8,314	17,769	Nil	Nil	Nil	Nil	13,631	5,373	26,660	13,987	...	19,408	13,063
Johore	...	2,619	3,578	3,472	7,580	2,986	7,609	Nil	2	Nil	11	945	5,840	1,859	13,328	...	2,410	3,462
Kedah	...	505	2,539	2,097	4,825	837	2,182	Nil	Nil	Nil	Nil	655	2,613	1,285	5,619	...	431	2,279
Perlis	...	20	8	6	13	8	28	Nil	Nil	Nil	Nil	Nil	3	Nil	36	...	29	10
Kelantan ...	...	226	63	158	241	400	983	25	Nil	25	Nil	63	486	97	1,031	...	199	124
Trengganu ...	..	55	50	90	207	45	103	Nil	Nil	Nil	Nil	Nil	135	Nil	310	..	55	50
Total Malay States	...	21,777	19,835	17,054	38,035	12,590	28,674	25	2	25	11	15,294	14,450	29,901	34,311	...	22,532	18,988
STRAITS SETTLEMENTS																		
Malacca ...	...	4,470	1,349	1,241	2,869			Nil		Nil		3,073		8,100		...	4,945	1,227
Province Wellesley	...	95	630	166	737	(2)	(2)	Nil		Nil						...	86	598
Dindings ...	...	126	98	101	217	1,651	4,100	Nil	14,483	Nil	34,395	6,959	Nil	13,105	Nil	...	187	116
Penang	2,958	7,014	13	1	10			664		1,608						1,595	5,609	10
Singapore ...	4,155	41,018	236	168	341			5,650		12,733		16,702		33,540		3,594	40,668	224
Total Straits Settlements	7,113	52,723	2,326	1,677	4,174	1,651	4,100	6,314	14,483	14,341	34,395	26,714	Nil	54,745	Nil	5,189	51,495	2,175
TOTAL MALAYA	7,113	74,500	22,161	18,731	42,209	14,241	32,774	6,339	14,485	14,366	34,406	42,008	14,450	84,646	34,311	5,189	74,027	21,163

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	16,423	37,028	5,210	4,992	921	64,574
WET RUBBER	2,985	3,640	399	226	1,489	8,739
TOTAL ...	19,408	40,668	5,609	5,218	2,410	73,313

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1932
Singapore ...	24,778	48,768
Penang ...	11,478	20,787
Port Swettenham.	5,361	11,951
Malacca ...	391	3,140
MALAYA ...	42,008	84,646

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1932
Malay States ... Straits Settlements	34,825	69,007
MALAYA ...	34,825	69,007

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i. e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd February, 1932.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1932.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation* .01 in or more	Precipitation, .05 in or more	Thunderstorm	Fog morning obs	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	91.8	70.9	81.3	96	68	80	74	83.3	83.8	7.34	186.5	1.30	16	13	9	2		192.85	6.65	
Bukit Jeram, Selangor ...	88.6	71.8	80.2	91	69	82	74	85.0	85.6	3.60	91.5	0.92	9	7				233.80	8.06	
Sitiawan, Perak ...	89.5	71.9	80.7	93	68	85	75	83.5	83.7	5.04	128.0	1.33	16	13	6	1		227.20	7.83	
Kroh, Perak ...	88.6	68.0	78.3	92	61	79	71	80.5	80.8	5.83	148.1	1.46	12	10	1	1		222.95	7.69	
Temerloh, Pahang ...	87.3	71.3	79.3	91	69	78	75	82.9	83.2	2.88	73.2	0.77	11	9	3	9		196.65	6.78	
Kuala Lipis, Pahang ...	87.8	71.0	79.4	91	67	80	74	82.7	82.5	3.78	96.0	1.06	14	9	2	15		197.40	6.81	
Kuala Pahang, Pahang ...	84.3	75.2	79.7	86	71	79	79	82.5	82.7	9.19	233.4	5.60	12	8	1			248.85	8.58	
Mount Faber, Singapore ...	88.1	72.3	80.2	90	70	80	74	80.5	81.3	5.12	130.1	2.72	11	8	4	2		219.75	7.58	
Butterworth, Province Wellesley ...	88.7	72.9	80.8	92	70	83	75	83.8	84.2	12.14	308.4	4.91	10	8			1	251.00	8.66	
Bukit China, Malacca ...	87.6	73.0	80.3	90	70	75	75	81.9	82.3	3.55	90.2	1.47	7	7	1			236.10	8.14	
Kluang, Johore ...	87.9	71.1	79.5	92	67	75	73	80.8	81.3	2.93	74.4	1.52	8	7	1	1		219.50	7.57	
Bukit Lalang, Mersing, Johore	82.9	72.0	77.5	85	68	78	77	79.3	79.2	11.19	284.2	6.08	7	5	1	1		227.95	7.86	
Alor Star, Kedah ...	92.6	70.2	81.4	95	65	88	74	83.8	84.1	1.92	48.8	1.61	4	4		2		251.40	8.67	
Kota Bahru, Kelantan ...	85.6	70.5	78.1	88	67	83	76	80.9	81.3	1.98	50.3	0.86	7	3				243.70	8.40	
Kuala Trengganu, Trengganu	84.4	71.0	77.7	87	69	79	76	81.4	81.5	1.78	45.2	0.89	8	6		2		243.45	8.39	
HILL STATIONS.																				
Cameron Highlands, Rhodendron Hill, Pahang 5120 ft. ...	73.3	57.8	65.1	75	55	67	60			9.09	230.9	1.98	19	4		2		161.35	5.56	
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.2	54.7	63.5	75	47	68	61	68.4	68.2	9.35	237.5	1.74	19	15		4		160.75	5.54	
Fraser's Hill, Pahang 4268 ft.	71.6	61.0	66.3	77	59	65	63	70.0	69.8	12.00	304.8	2.51	18	14		21		159.25	5.49	

Compiled from Returns supplied by the Meteorological Branch, Malaya.